User's Manual

DPharp EJX®

EJX910A and EJX930A Multivariable Transmitter HART Communication Type

IM 01C25R02-01E

vigilantplant®

DPharp FOR THE DIGITAL WORLD

YOKOGAWA
Yokogawa Electric Corporation

IM 01C25R02-01E
7th Edition

EJX910A and EJX930A
Multivariable Transmitter
HART Communication Type

IM 01C25R02-01E 7th Edition

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Revision Information

1. Introduction

Thank you for purchasing the DPharp EJX multivariable transmitter.

EJX multivariable transmitters are precisely calibrated at the factory before shipment.
To ensure both safety and efficiency, please read this manual carefully before operating the instrument.
This manual describes the HART protocol communication functions of the EJX multivariable transmitter and explains how to set the parameters for EJX multivariable transmitters using the HART configuration tool.
For information on the installation, wiring, and maintenance of EJX multivariable transmitters, please refer to the user's manual.
For information on the flow setup of EJX multivariable transmitters, please refer to the user's manual and FSA120 FieldMate FlowNavigator on-line manual.

EJX910A / EJX930A	IM 01C25R01-01E
FSA110 / 111 FieldMate Versatile Device Management Wizard	IM 01R01A01-01E
FSA120 FieldMate FlowNavigator	IM 01C25R51-01E

WARNING

When using the EJX in a Safety Instrumented Systems (SIS) application, refer to Appendix 1 in this manual. The instructions and procedures in the appendix must be strictly followed in order to maintain the designed safety integrity of the transmitter.

■ Regarding This Manual

- This manual should be provided to the end user.
- The contents of this manual are subject to change without prior notice.
- All rights reserved. No part of this manual may be reproduced in any form without Yokogawa's written permission.
- Yokogawa makes no warranty of any kind with regard to this manual, including, but not limited to, implied warranty of merchantability and fitness for a particular purpose.
- If any question arises or errors are found, or if any information is missing from this manual, please inform the nearest Yokogawa sales office.
- The specifications covered by this manual are limited to those for the standard type under the specified model number break-down and do not cover custom-made instruments.
- Please note that changes in the specifications, construction, or component parts of the instrument may not immediately be reflected in this manual at the time of change, provided that postponement of revisions will not cause difficulty to the user from a functional or performance standpoint.
- The following safety symbols are used in this manual:

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

IMPORTANT

Indicates that operating the hardware or software in this manner may damage it or lead to system failure.

NOTE

Draws attention to information essential for understanding the operation and features.

1.1 Safe Use of This Product

For the safety of the operator and to protect the instrument and the system, please be sure to follow this manual's safety instructions when handling this instrument. If these instructions are not heeded, the protection provided by this instrument may be impaired. In this case, Yokogawa cannot guarantee that the instrument can be safely operated. Please pay special attention to the following points:

(a) Installation

- This instrument may only be installed by an engineer or technician who has an expert knowledge of this device. Operators are not allowed to carry out installation unless they meet this condition.
- With high process temperatures, care must be taken not to burn yourself by touching the instrument or its casing.
- Never loosen the process connector nuts when the instrument is installed in a process. This can lead to a sudden, explosive release of process fluids.
- When draining condensate from the pressure detector section, take appropriate precautions to prevent the inhalation of harmful vapors and the contact of toxic process fluids with the skin or eyes.
- When removing the instrument from a hazardous process, avoid contact with the process fluid and the interior of the meter.
- All installation shall comply with local installation requirements and the local electrical code.

(b) Wiring

- The instrument must be installed by an engineer or technician who has an expert knowledge of this instrument. Operators are not permitted to carry out wiring unless they meet this condition.
- Before connecting the power cables, please confirm that there is no current flowing through the cables and that the power supply to the instrument is switched off.

(c) Operation

- Wait 10 min. after the power is turned off before opening the covers.

(d) Maintenance

- Please carry out only the maintenance procedures described in this manual. If you require further assistance, please contact the nearest Yokogawa office.
- Care should be taken to prevent the build up of dust or other materials on the display glass and the name plate. To clean these surfaces, use a soft, dry cloth.

(e) Modification

- Yokogawa will not be liable for malfunctions or damage resulting from any modification made to this instrument by the customer.

1.2 Warranty

- The warranty shall cover the period noted on the quotation presented to the purchaser at the time of purchase. Problems occurring during the warranty period shall basically be repaired free of charge.
- If any problems are experienced with this instrument, the customer should contact the Yokogawa representative from which this instrument was purchased or the nearest Yokogawa office.
- If a problem arises with this instrument, please inform us of the nature of the problem and the circumstances under which it developed, including the model specification and serial number. Any diagrams, data and other information you can include in your communication will also be helpful.
- The party responsible for the cost of fixing the problem shall be determined by Yokogawa following an investigation conducted by Yokogawa.
- The purchaser shall bear the responsibility for repair costs, even during the warranty period, if the malfunction is due to:
  - Improper and/or inadequate maintenance by the purchaser.
  - Malfunction or damage due to a failure to handle, use, or store the instrument in accordance with the design specifications.
  - Use of the product in question in a location not conforming to the standards specified by Yokogawa, or due to improper maintenance of the installation location.
  - Failure or damage due to modification or repair by any party except Yokogawa or an approved representative of Yokogawa.
  - Malfunction or damage from improper relocation of the product in question after delivery.
  - Reason of force majeure such as fires, earthquakes, storms/floods, thunder/ lightening, or other natural disasters, or disturbances, riots, warfare, or radioactive contamination.

1.3 ATEX Documentation

This is only applicable to the countries in European Union.

GB
All instruction manuals for ATEX Ex related products are available in English, German and French. Should you require Ex related instructions in your local language, you are to contact your nearest Yokogawa office or representative.

DK
Alle brugervejledninger for produkter relateret til ATEX Ex er tilgængelige på engelsk, tysk og fransk. Skulle De ønske yderligere oplysninger om håndtering af Ex produkter på eget sprog, kan De rette henvendelse herom til den nærmeste Yokogawa afdeling eller forhandler.

I
Tutti i manuali operativi di prodotti ATEX contrassegnati con Ex sono disponibili in inglese, tedesco e francese. Se si desidera ricevere i manuali operativi di prodotti Ex in lingua locale, mettersi in contatto con l'ufficio Yokogawa più vicino o con un rappresentante.

E
Todos los manuales de instrucciones para los productos antiexplosivos de ATEX están disponibles en inglés, alemán y francés. Si desea solicitar las instrucciones de estos artículos antiexplosivos en su idioma local, deberá ponerse en contacto con la oficina o el representante de Yokogawa más cercano.

NL
Alle handleidingen voor producten die te maken hebben met ATEX explosiebeveiliging (Ex) zijn verkrijgbaar in het Engels, Duits en Frans. Neem, indien u aanwijzingen op het gebied van explosiebeveiliging nodig hebt in uw eigen taal, contact op met de dichtstbijzijnde vestiging van Yokogawa of met een vertegenwoordiger.

SF
Kaikkien ATEX Ex -tyyppisten tuotteiden käyttöhjeet ovat saatavilla englannin-, saksan- ja ranskankielisinä. Mikäli tarvitsette Ex -tyyppisten tuotteiden ohjeita omalla paikallisella kielellännne, ottakaa yhteyttä lähimpään Yokogawa-toimistoon tai -edustajaan.

P
Todos os manuais de instruções referentes aos produtos Ex da ATEX estão disponíveis em Inglês, Alemão e Francês. Se necessitar de instruções na sua língua relacionadas com produtos Ex, deverá entrar em contacto com a delegação mais próxima ou com um representante da Yokogawa.

F
Tous les manuels d'instruction des produits ATEX Ex sont disponibles en langue anglaise, allemande et française. Si vous nécessitez des instructions relatives aux produits Ex dans votre langue, veuillez bien contacter votre représentant Yokogawa le plus proche.

D
Alle Betriebsanleitungen für ATEX Ex bezogene Produkte stehen in den Sprachen Englisch, Deutsch und Französisch zur Verfügung. Sollten Sie die Betriebsanleitungen für Ex-Produkte in Ihrer Landessprache benötigen, setzen Sie sich bitte mit Ihrem örtlichen Yokogawa-Vertreter in Verbindung.

S
Alla instruktionsböcker för ATEX Ex (explosionssäkra) produkter är tillgängliga på engelska, tyska och franska. Om Ni behöver instruktioner för dessa explosionssäkra produkter på annat språk, skall Ni kontakta närmaste Yokogawakontor eller representant.

GR
Όλα τα εγχειρίδια λειτουργίας των προϊόντων με ATEX Ex διατίθενται στα Αγγλικά, Γερμανικά και Γαλλικά. Σε περίπτωση που χρειάζεστε οδηγίες σχετικά με Ex στην τοπική γλώσσα παρακαλούμε επικοινωνήστε με το πλησιέστερο γραφείο της Yokogawa ή αντιπρόσωπο της.

SK
Všetky návody na obsluhu pre prístroje s ATEX Ex sú k dispozícii v jazyku anglickom, nemeckom a francúzskom. V prípade potreby návodu pre Ex-prístroje vo Vašom národnom jazyku, skontaktujte prosím miestnu kanceláriu firmy Yokogawa.

CZ
Všechny uživatelské příručky pro výrobky, na něž se vztahuje nevýbušné schválení ATEX Ex, jsou dostupné v angličtině, němčině a francouzštině. Požadujete-li pokyny týkající se výrobků s nevýbušným schválením ve vašem lokálním jazyku, kontaktujte prosím vaši nejbližší reprezentační kancelář Yokogawa.

LT
Visos gaminiø ATEX Ex kategorijos Eksploatavimo instrukcijos teikiami anglø, vokieèiø ir prancûzø kalbomis. Norëdami gauti prietaisø Ex dokumentacijà kitomis kalbomis susisiekite su artimiausiu bendrovës "Yokogawa" biuru arba atstovu.

LV
Visas ATEX Ex kategorijas izstrâdâjumu Lietoðanas instrukcijas tiek piegâdâtas angïu, vâcu un franèu valodâs. Ja vçlaties saòemt Ex ierîèu dokumentâciju citâ valodâ, Jums ir jâsazinâs ar firmas Jokogava (Yokogawa) tuvâko ofisu vai pârstâvi.

EST
Kõik ATEX Ex toodete kasutamisjuhendid on esitatud inglise, saksa ja prantsuse keeles. Ex seadmete muukeelse dokumentatsiooni saamiseks pöörduge lähima lokagava (Yokogawa) kontori või esindaja poole.

PL
Wszystkie instrukcje obsługi dla urządzeń w wykonaniu przeciwwybuchowym Ex, zgodnych z wymaganiami ATEX, dostępne są w języku angielskim, niemieckim i francuskim. Jeżeli wymagana jest instrukcja. obsługi w Państwa lokalnym ję zyku, prosimy o kontakt z najbliższym biurem Yokogawy.

SLO
Vsi predpisi in navodila za ATEX Ex sorodni pridelki so pri roki v angliščini, nemščini ter francoščini. Če so Ex sorodna navodila potrebna v vašem tukejnjem jeziku, kontaktirajte vaš najbliši Yokogawa office ili predstaunika.

H
Az ATEX Ex mûszerek gépkönyveit angol, német és francia nyelven adjuk ki. Amennyiben helyi nyelven kérik az Ex eszközök leírásait, kérjük keressék fel a legközelebbi Yokogawa irodát, vagy képviseletet.

BG
Всички упътвания за продукти от серията ATEX Ex се предлагат на английски, немски и френски език. Ако се нуждаете от упътвания за продукти от серията Ex на родния ви език, се свържете с най-близкия офис или представителство на фирма Yokogawa.

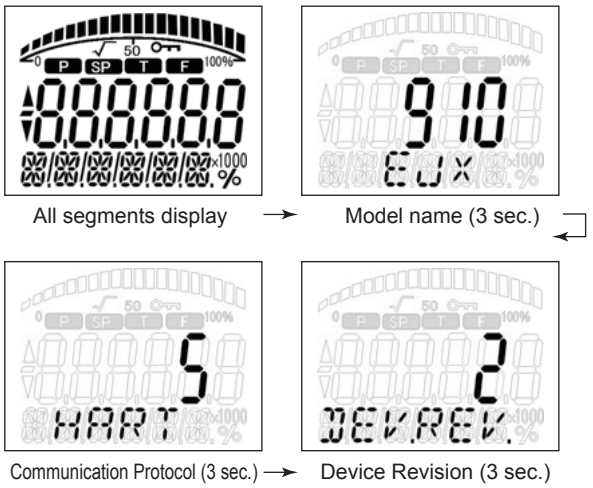
RO
Toate manualele de instructiuni pentru produsele ATEX Ex sunt in limba engleza, germana si franceza. In cazul in care doriti instructiunile in limba locala, trebuie sa contactati cel mai apropiat birou sau reprezentant Yokogawa.

M
Il-manwali kollha ta' l-istruzzjonijiet għal prodotti marbuta ma' ATEX Ex huma disponibbli bl-Ingliż, bil-Ġermaniż u bil-Franċiż. Jekk tkun teħtieġ struzzjonijiet marbuta ma' Ex fil-lingwa lokali tiegħek, għandek tikkuntattja lil l-eqreb rappreżentan jew uffiċċju ta' Yokogawa.

2. Connection

2.1 Integral Indicator Display When Powering On

For models with the integral indicator code “D”, the display shows all segments in the LCD and then changes to the displays shown below sequentially.



Either “5” or “7” is displayed on the communication protocol display as HART protocol revision followed by device revision number on the device revision display.

NOTE

For output signal code “E”, this function is available for software revision 3.01 or later. Software revision can be checked by the following procedure.

DD(HART 5)	**[Root Menu]**(Refer to subsection 3.1.1) → Review → Software rev
DTM(HART 5)	Configuration → Device information1 → Software rev

NOTE

In this User’s Manual, HART protocol revision 5 and 7 are described as HART 5 and HART 7 respectively.

NOTE

LCD display can be set to all segments display only.

• Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** (Refer to subsection 3.1.1) → Detailed setup → Display condition → Chg power on info
DTM (HART 5)	Configuration → Local Display → Chg power on info
On	Show all segments display, Model name, Communication Protocol, and Device Revision when powering on.
Off	Show all segments display when powering on.

2.2 HART Protocol Revision

For the models with the output signal code “-J”, HART protocol revision 5 or 7 is selectable. The protocol revision is set as specified in the order.

The typical function which is available by HART protocol revision 7 is listed as follows. Refer to HART 7 description in this document or HART 7 mark for detail.

- Long Tag Supporting Up to 32 Characters
  Long tag secures a better asset management with abundant digits in its software.
- Enhanced Burst Mode and Event Notification
  Advanced burst mode includes the variety of transmission setting by specifying burst variables, update period, and message trigger mode, and event notification function gives you alert signal based on the status change in preset values and self-diagnosis.
- Squawk
  Identifying the transmitter by displaying the particular pattern on LCD
- Multidrop Communication
  Up to 63 transmitters can be connected. An analog signal output available for one device in a loop.

How to confirm protocol revision is shown below.

There are three ways to confirm the protocol revision set to the transmitter.

(1) Confirmation by the name plate
The HART protocol revision is shown by the last number of the serial number.
Refer to Figure 2.1.

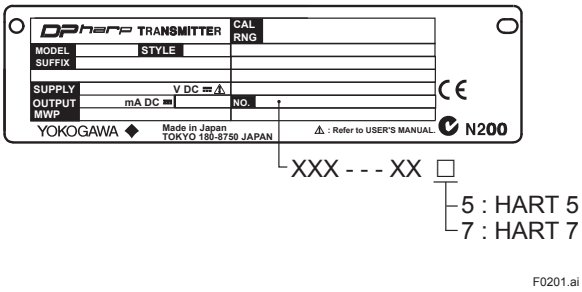


Figure 2.1 Name Plate

(2) Confirmation by using integral indicator (When the integral indicator code is "D")
Refer to section 2.1.

(3) Confirmation by using HART configuration tool
Follow the procedure below.
1) Connect the configuration tool to the transmitter.
2)-1 When using DD(HART 5/HART 7) or DTM(HART 7) configuration tool.
Select the "Root Menu" (Refer to subsection 3.1.1)
Call up the "Review" display.
2)-2 When using DTM(HART 5) configuration tool.
Call up "HART" display.
Configuration → HART
3) HART protocol revision is displayed on the "Universal rev" column.

IMPORTANT

Protocol revision supported by HART configuration tool must be the same or higher than that of the EJX multivariable transmitter.

		Protcol revision supported by HART configuration tool	
		5	7
Protocol revision of EJX multivariable transmitter	5	○	○
	7	×	○

○ : Communication OK
× : Communication NG

NOTE

HART 7 communication is supported by FieldMate R2.02 or later.

NOTE

When the output signal code of EJX multivariable transmitter is "-J", HART protocol revision can be changed. Refer to subsection 3.3.17 about the procedure of the revision change of HART 5 and HART 7.

2.3 Device Description (DD) on a Configuration Tool and Transmitter Device Revision

Before using a HART configuration tool, confirm that the DD for the transmitter is installed in the configuration tool.

About the DD, use the device type, device revision and DD Revision shown in the Table 2.1.

Table 2.1 HART Protocol Revision, Device Revision and DD Revision

HART Protocol Revision (*1)	EJX Multivariable Transmitter			
	Model Name	Device Type	Device Revision	DD Revision
5	EJX910A EJX930A	EJX-MV (0x54)	2	2 or later
7	EJX910A EJX930A	EJX-MV (0x3754)	10	1 or later

*1: When the output signal code is "–E", only "5" is available.

The device revision of the transmitter and DD can be confirmed as shown below.

If the correct DD is not installed in the configuration tool, download it from the official web site of HART Communication Foundation.

(1) Confirming the device revision of the transmitter
- Confirmation by using integral indicator
  (When the integral indicator code is “D”)
  Refer to the section 2.1
- Confirmation by using HART configuration tool
  Follow the procedure below.
  1) Connect the configuration tool to the transmitter.
  2) Select the “Root Menu” (Refer to subsection 3.1.1)
     Call up the “Review” display.
  3) The device revision is displayed on the “Fld dev rev” column.

(2) Confirming the device revision of the configuration tool
Confirm the device revision from the installed DD file name according to the procedure provided for the configuration tool.
The first two digits indicate the device revision and the next two digits indicate the DD revision.

0 a 0 1. X X X
- **DD revision**
- **Device revision**

NOTE

Device revision of DD file is given in hexadecimal

2.4 Set the parameters using DTM

When configure the parameters using FieldMate, use the DTM (Device Type Manager) shown in the Table 2.2.

Table 2.2 HART Protocol Revision and DTM

HART Protocol Revision	DTM		EJX multivariable transmitters		
	Name	Revision	Model Name	Device Type	Device Revision
5	EJX910 V2.1	1.4.160.27*1 or later	EJX910A EJX930A	EJX910 (0x54)	2
7	EJX910 HART 7 DTM	3.3.0.112*2 or later	EJX910A EJX930A	EJX910_ EXP (0x3754)	10

*1: The DTM corresponding to this revision is included in Yokogawa DTM Library HART 2011-3/Device Files R3.03.00
*2: The DTM corresponding to this revision is included in Yokogawa Device DTM Library 2.0/Device Files R3.03.00

NOTE

The DTM revision can be confirmed by “DTM setup”.
Device Files is a Media included in FieldMate.
The user registration site provides Device Files with the latest update programs.
(URL: https://voc.yokogawa.co.jp/PMK/)
In case update, following operation by “DTM setup” is required.
- Update DTM catalog
- Assign corresponding DTM to the device (refer to Table 2.2)

Refer to FieldMate Instruction Manual for detail.

2.5 Interconnection Between DPharp and the HART Configuration Tool

The HART configuration tool can interface with the transmitter from the control room, the transmitter site, or any other wiring termination point in the loop, provided there is a minimum of 250 Ω between the connection and the power supply. To communicate, it must be connected in parallel with the transmitter; the connections are non-polarized. Figure 2.2 illustrates the wiring connections for direct interface at the transmitter site for the DPharp. The HART configuration tool can be used for remote access from any terminal strip as well.

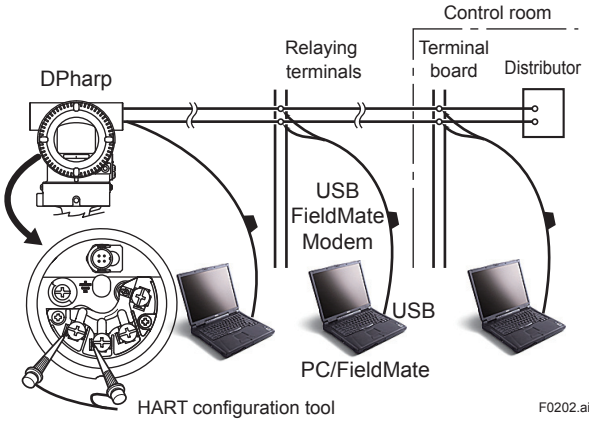


Figure 2.2 Connecting the HART Configuration Tool

2.6 Power Supply Voltage and Load Resistance

When configuring the loop, make sure that the external load resistance is within the range in the figure below.

(Note) With an intrinsically safe transmitter, external load resistance includes safety barrier resistance.

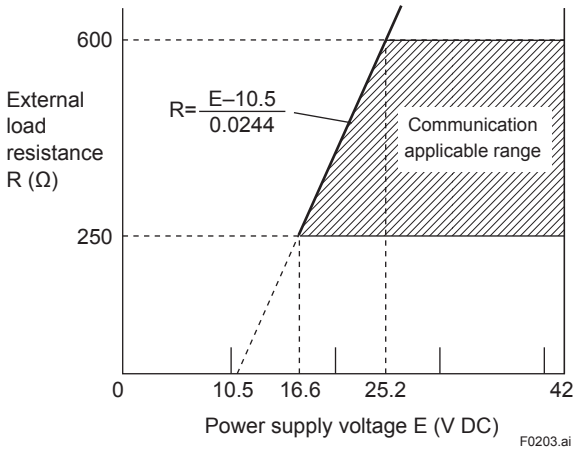


Figure 2.3 Relationship between Power Supply Voltage and External Load Resistance

3. Parameter Setting

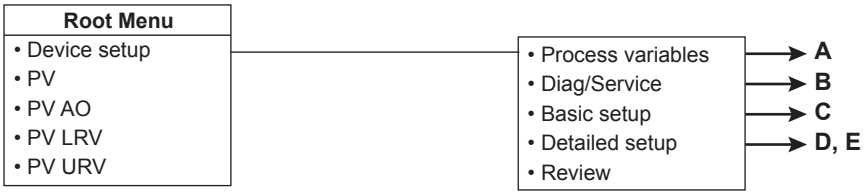
3.1 Menu Tree

The menu tree is different in DD(HART 5/HART 7)/DTM(HART 7) and DTM(HART 5).

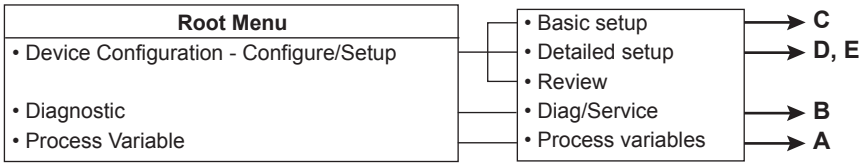
See the menu tree corresponding to the configuration tool.

3.1.1 For DD (HART 5/HART 7) and DTM (HART 7)

■ DD (HART 5/HART 7)



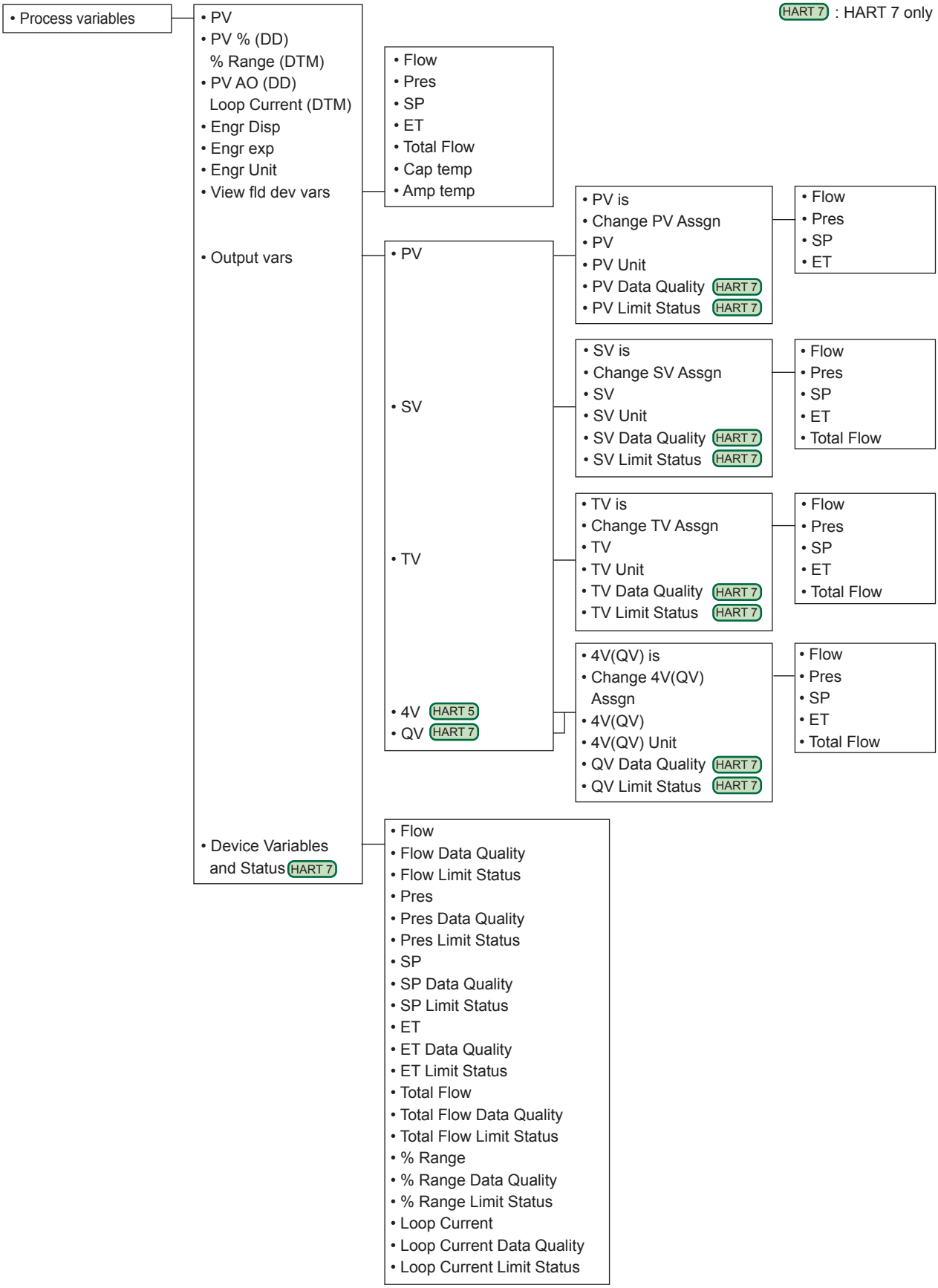
■ DTM (HART 7)



F0301-01.ai

A

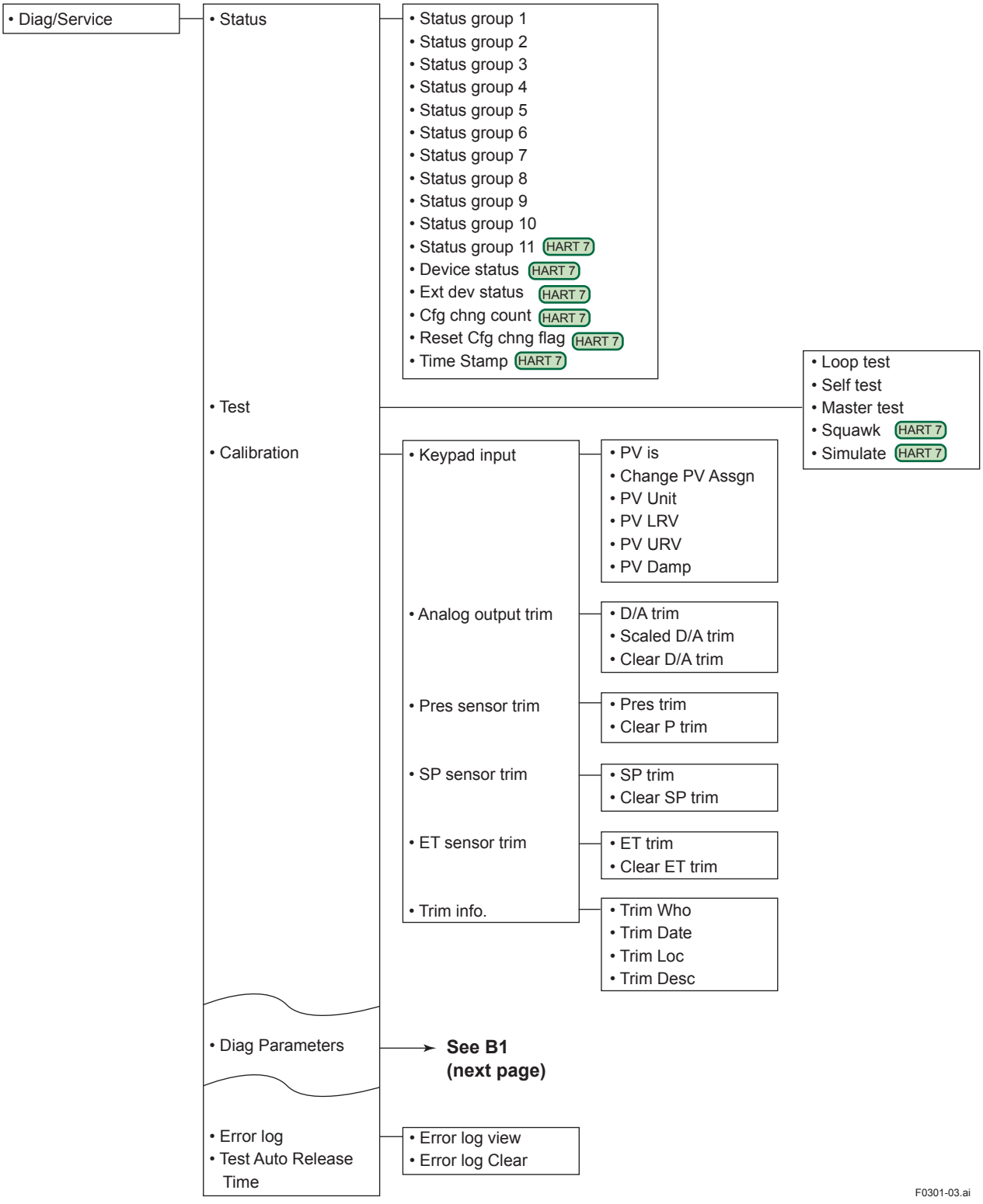
HART 5 : HART 5 only
HART 7 : HART 7 only

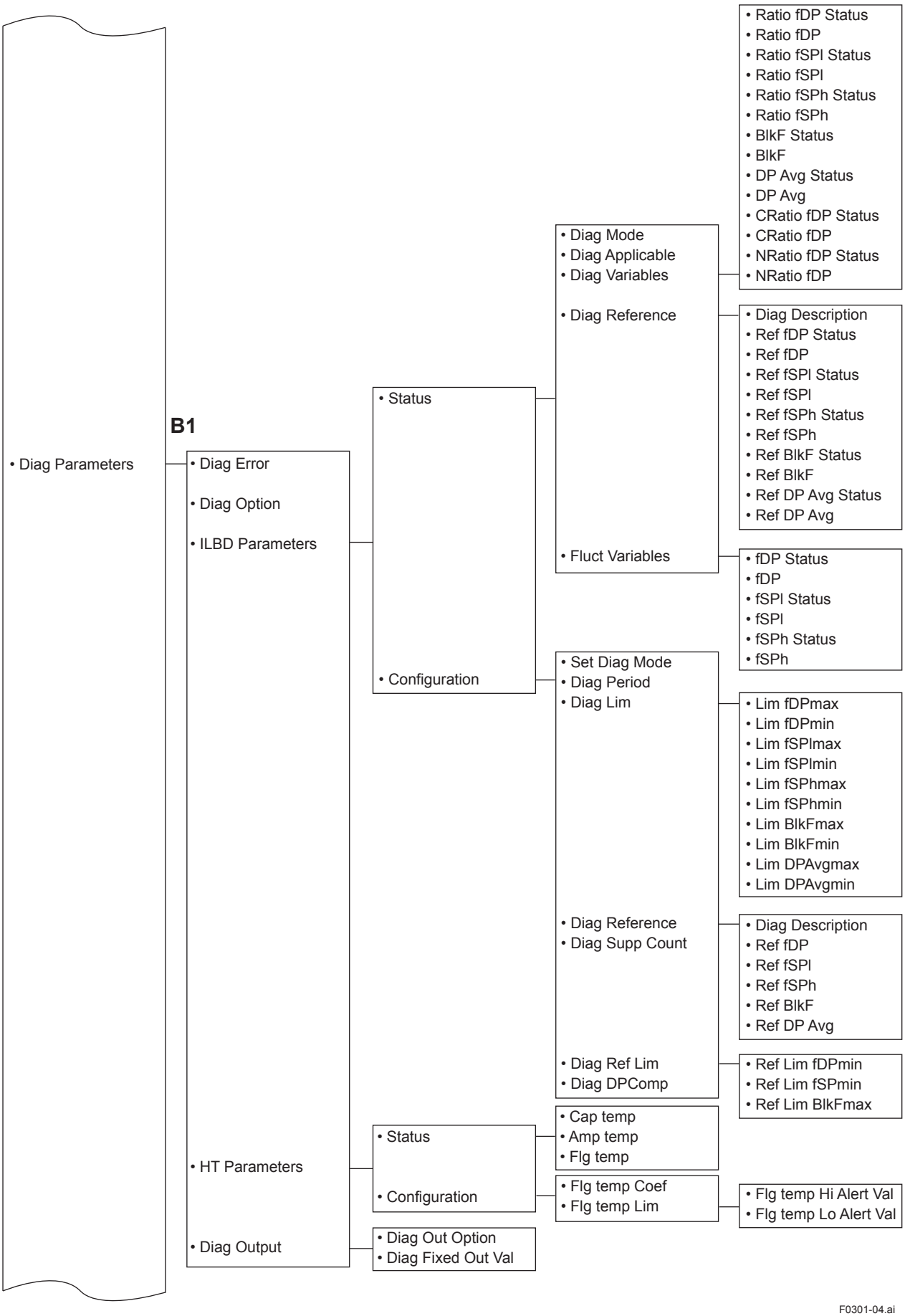


F0301-02.ai

B

HART 7 : HART 7 only

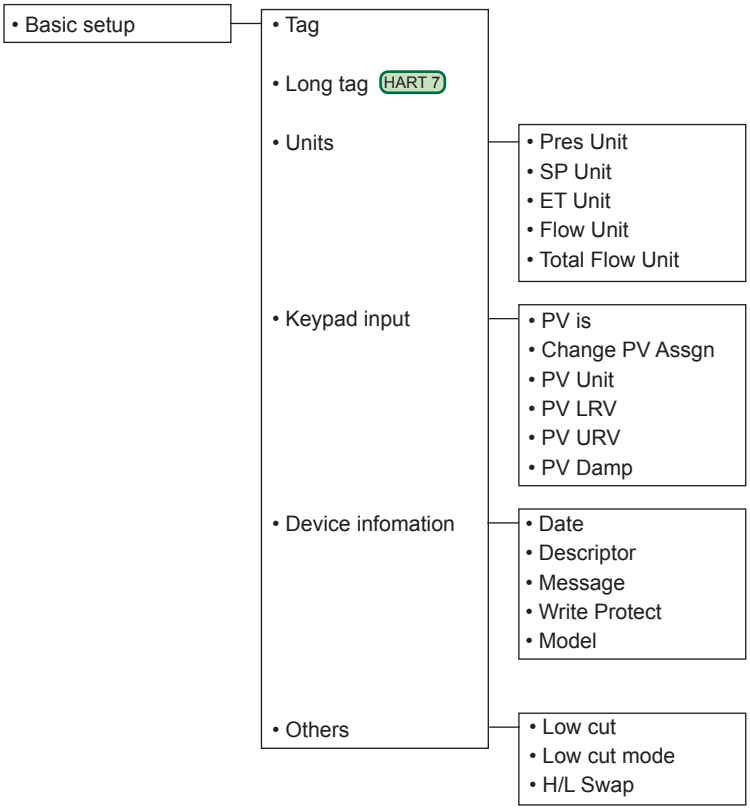



• Diag Parameters
B1
• Diag Error
• Diag Option
• ILBD Parameters
• HT Parameters
• Diag Output
• Status
• Configuration
• Status
• Configuration
• Diag Out Option
• Diag Fixed Out Val
• Diag Mode
• Diag Applicable
• Diag Variables
• Diag Reference
• Fluct Variables
• Set Diag Mode
• Diag Period
• Diag Lim
• Diag Reference
• Diag Supp Count
• Diag Ref Lim
• Diag DPComp
• Cap temp
• Amp temp
• Flg temp
• Flg temp Coef
• Flg temp Lim
• Ratio fDP Status
• Ratio fDP
• Ratio fSPl Status
• Ratio fSPl
• Ratio fSPh Status
• Ratio fSPh
• BlkF Status
• BlkF
• DP Avg Status
• DP Avg
• CRatio fDP Status
• CRatio fDP
• NRatio fDP Status
• NRatio fDP
• Diag Description
• Ref fDP Status
• Ref fDP
• Ref fSPl Status
• Ref fSPl
• Ref fSPh Status
• Ref fSPh
• Ref BlkF Status
• Ref BlkF
• Ref DP Avg Status
• Ref DP Avg
• fDP Status
• fDP
• fSPl Status
• fSPl
• fSPh Status
• fSPh
• Lim fDPmax
• Lim fDPmin
• Lim fSPlmax
• Lim fSPlmin
• Lim fSPhmax
• Lim fSPhmin
• Lim BlkFmax
• Lim BlkFmin
• Lim DPAvgmax
• Lim DPAvgmin
• Diag Description
• Ref fDP
• Ref fSPl
• Ref fSPh
• Ref BlkF
• Ref DP Avg
• Ref Lim fDPmin
• Ref Lim fSPmin
• Ref Lim BlkFmax
• Flg temp Hi Alert Val
• Flg temp Lo Alert Val

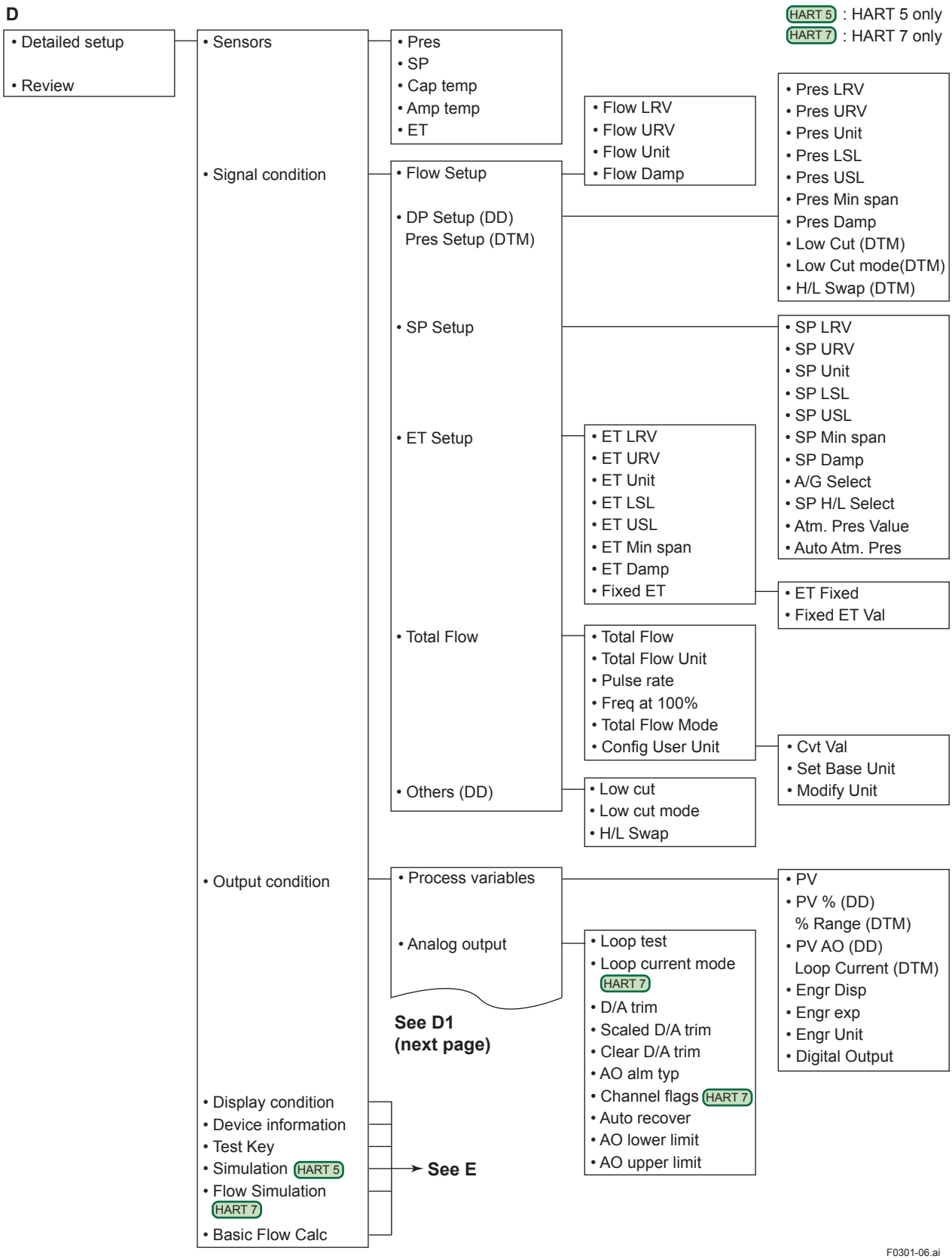
F0301-04.ai

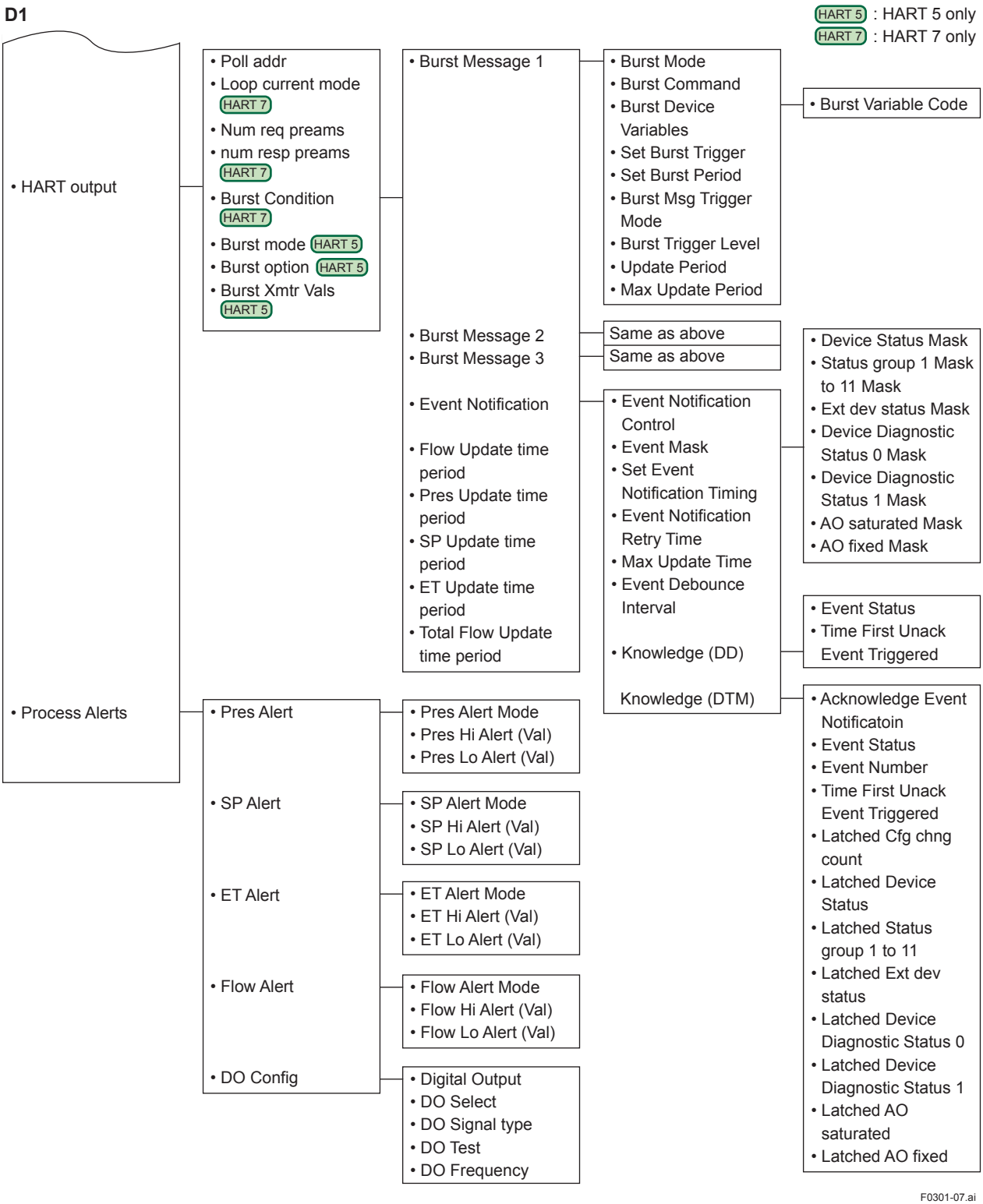
C

HART 7 : HART 7 only



F0301-05.ai

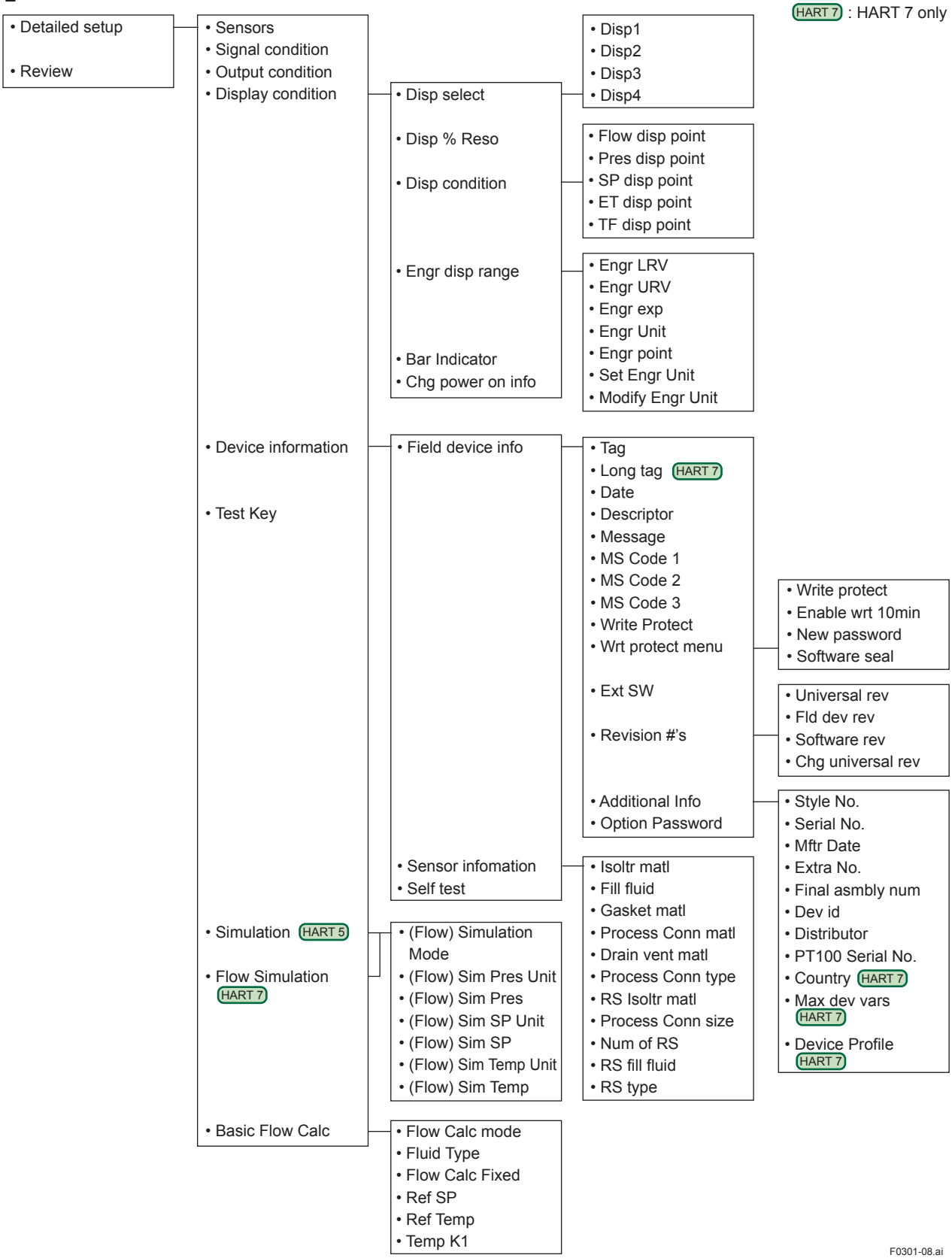

D
HART 5 : HART 5 only
HART 7 : HART 7 only
• Detailed setup
• Review
• Sensors
• Signal condition
• Output condition
• Display condition
• Device information
• Test Key
• Simulation HART 5
• Flow Simulation HART 7
• Basic Flow Calc
• Pres
• SP
• Cap temp
• Amp temp
• ET
• Flow Setup
• DP Setup (DD)
Pres Setup (DTM)
• SP Setup
• ET Setup
• Total Flow
• Others (DD)
• Process variables
• Analog output
See D1
(next page)
See E
• Flow LRV
• Flow URV
• Flow Unit
• Flow Damp
• Pres LRV
• Pres URV
• Pres Unit
• Pres LSL
• Pres USL
• Pres Min span
• Pres Damp
• Low Cut (DTM)
• Low Cut mode(DTM)
• H/L Swap (DTM)
• SP LRV
• SP URV
• SP Unit
• SP LSL
• SP USL
• SP Min span
• SP Damp
• A/G Select
• SP H/L Select
• Atm. Pres Value
• Auto Atm. Pres
• ET LRV
• ET URV
• ET Unit
• ET LSL
• ET USL
• ET Min span
• ET Damp
• Fixed ET
• ET Fixed
• Fixed ET Val
• Total Flow
• Total Flow Unit
• Pulse rate
• Freq at 100%
• Total Flow Mode
• Config User Unit
• Cvt Val
• Set Base Unit
• Modify Unit
• Low cut
• Low cut mode
• H/L Swap
• PV
• PV % (DD)
% Range (DTM)
• PV AO (DD)
Loop Current (DTM)
• Engr Disp
• Engr exp
• Engr Unit
• Digital Output
• Loop test
• Loop current mode HART 7
• D/A trim
• Scaled D/A trim
• Clear D/A trim
• AO alm typ
• Channel flags HART 7
• Auto recover
• AO lower limit
• AO upper limit
F0301-06.ai


D1
HART 5 : HART 5 only
HART 7 : HART 7 only
• HART output
• Poll addr
• Loop current mode HART 7
• Num req preams
• num resp preams HART 7
• Burst Condition HART 7
• Burst mode HART 5
• Burst option HART 5
• Burst Xmtr Vals HART 5
• Burst Message 1
• Burst Mode
• Burst Command
• Burst Device Variables
• Set Burst Trigger
• Set Burst Period
• Burst Msg Trigger Mode
• Burst Trigger Level
• Update Period
• Max Update Period
• Burst Variable Code
• Burst Message 2
Same as above
• Burst Message 3
Same as above
• Event Notification
• Event Notification Control
• Event Mask
• Set Event Notification Timing
• Event Notification Retry Time
• Max Update Time
• Event Debounce Interval
• Device Status Mask
• Status group 1 Mask to 11 Mask
• Ext dev status Mask
• Device Diagnostic Status 0 Mask
• Device Diagnostic Status 1 Mask
• AO saturated Mask
• AO fixed Mask
• Flow Update time period
• Pres Update time period
• SP Update time period
• ET Update time period
• Total Flow Update time period
• Knowledge (DD)
• Event Status
• Time First Unack Event Triggered
Knowledge (DTM)
• Acknowledge Event Notificatoin
• Event Status
• Event Number
• Time First Unack Event Triggered
• Latched Cfg chng count
• Latched Device Status
• Latched Status group 1 to 11
• Latched Ext dev status
• Latched Device Diagnostic Status 0
• Latched Device Diagnostic Status 1
• Latched AO saturated
• Latched AO fixed
• Process Alerts
• Pres Alert
• Pres Alert Mode
• Pres Hi Alert (Val)
• Pres Lo Alert (Val)
• SP Alert
• SP Alert Mode
• SP Hi Alert (Val)
• SP Lo Alert (Val)
• ET Alert
• ET Alert Mode
• ET Hi Alert (Val)
• ET Lo Alert (Val)
• Flow Alert
• Flow Alert Mode
• Flow Hi Alert (Val)
• Flow Lo Alert (Val)
• DO Config
• Digital Output
• DO Select
• DO Signal type
• DO Test
• DO Frequency

F0301-07.ai

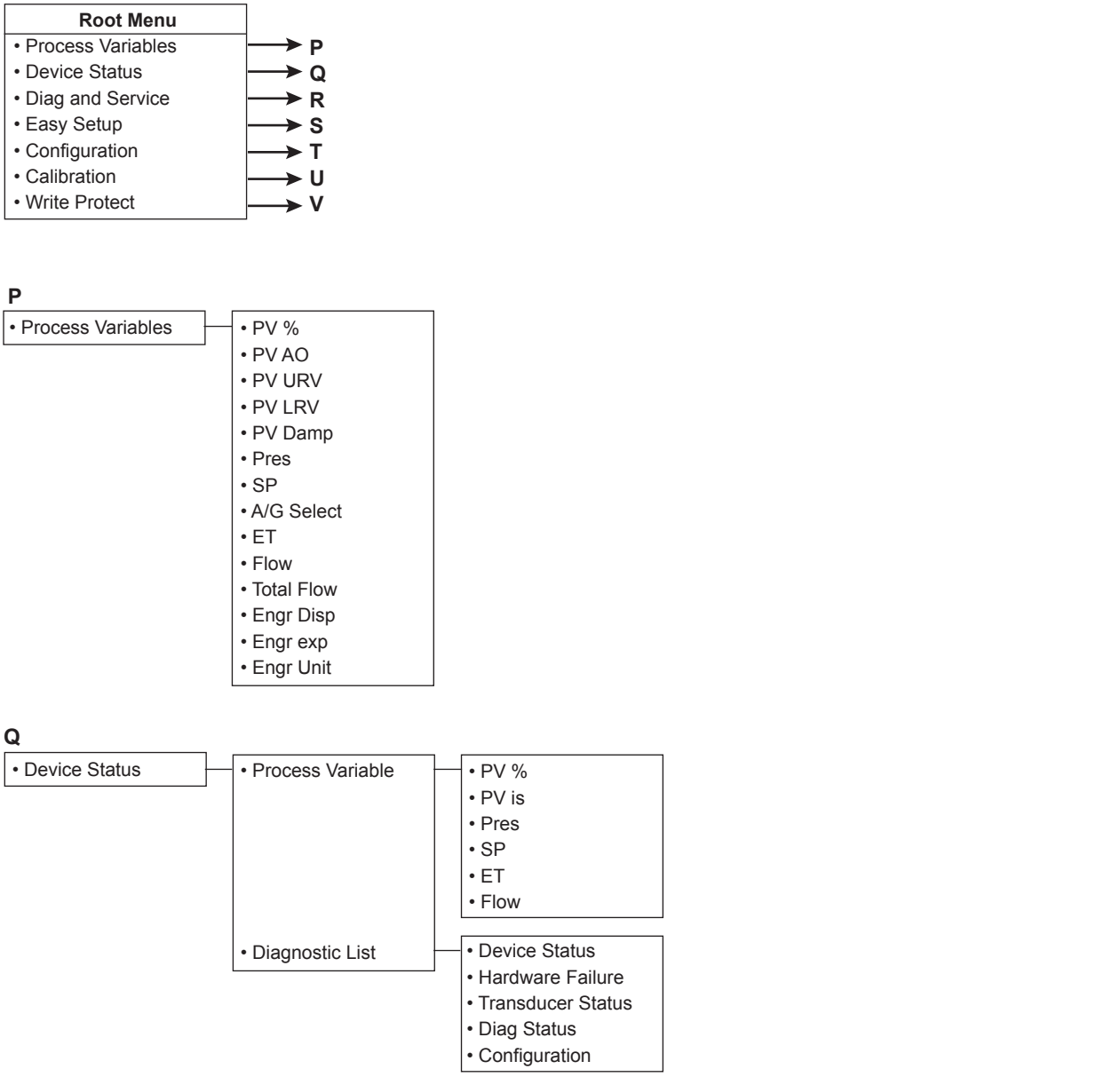
E

HART 5 : HART 5 only
HART 7 : HART 7 only



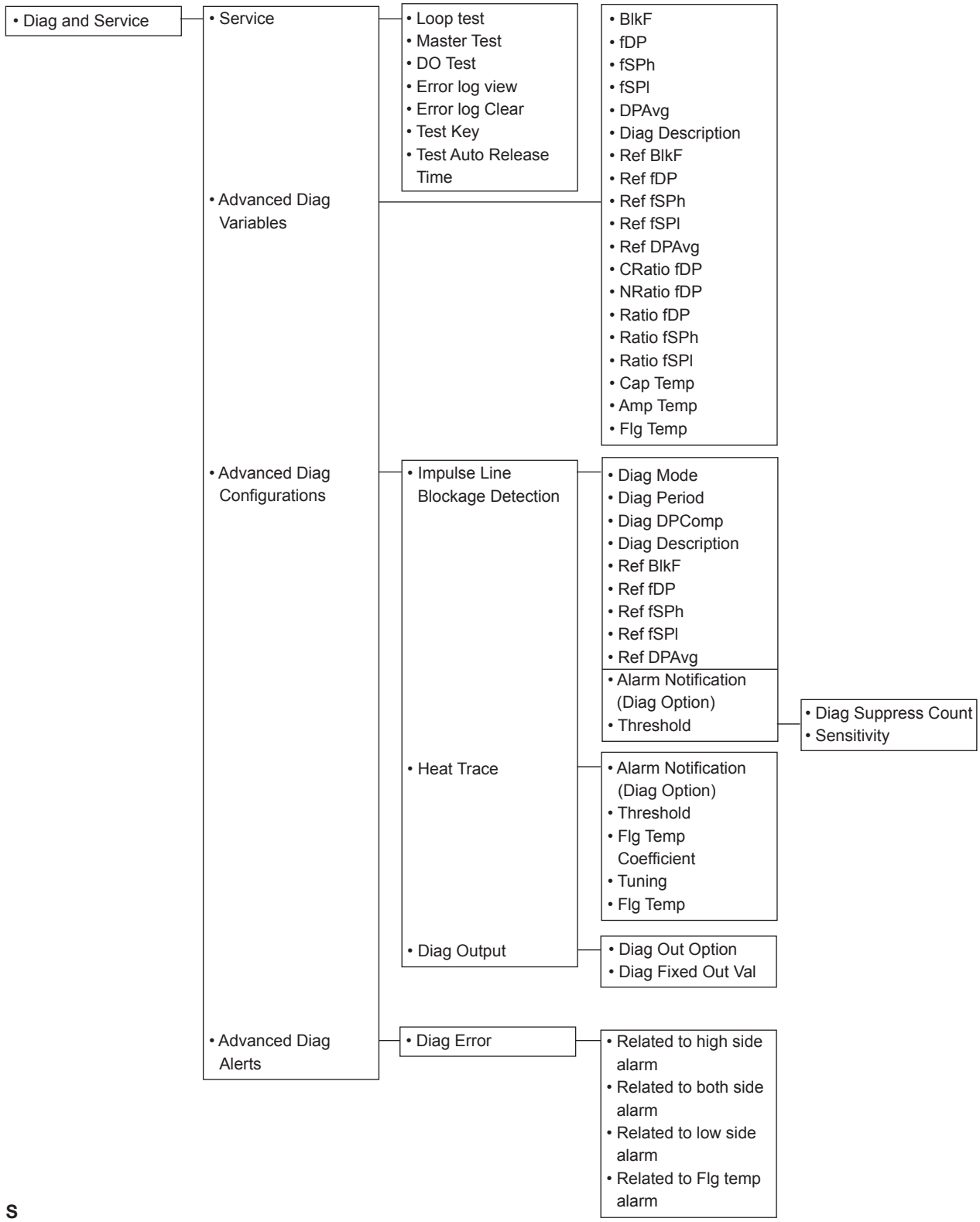
F0301-08.ai

3.1.2 For DTM (HART 5)

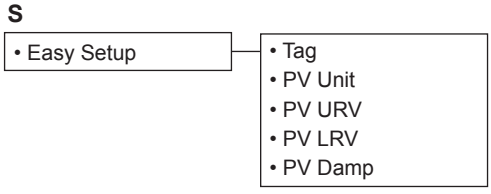


F0301-09.ai

R

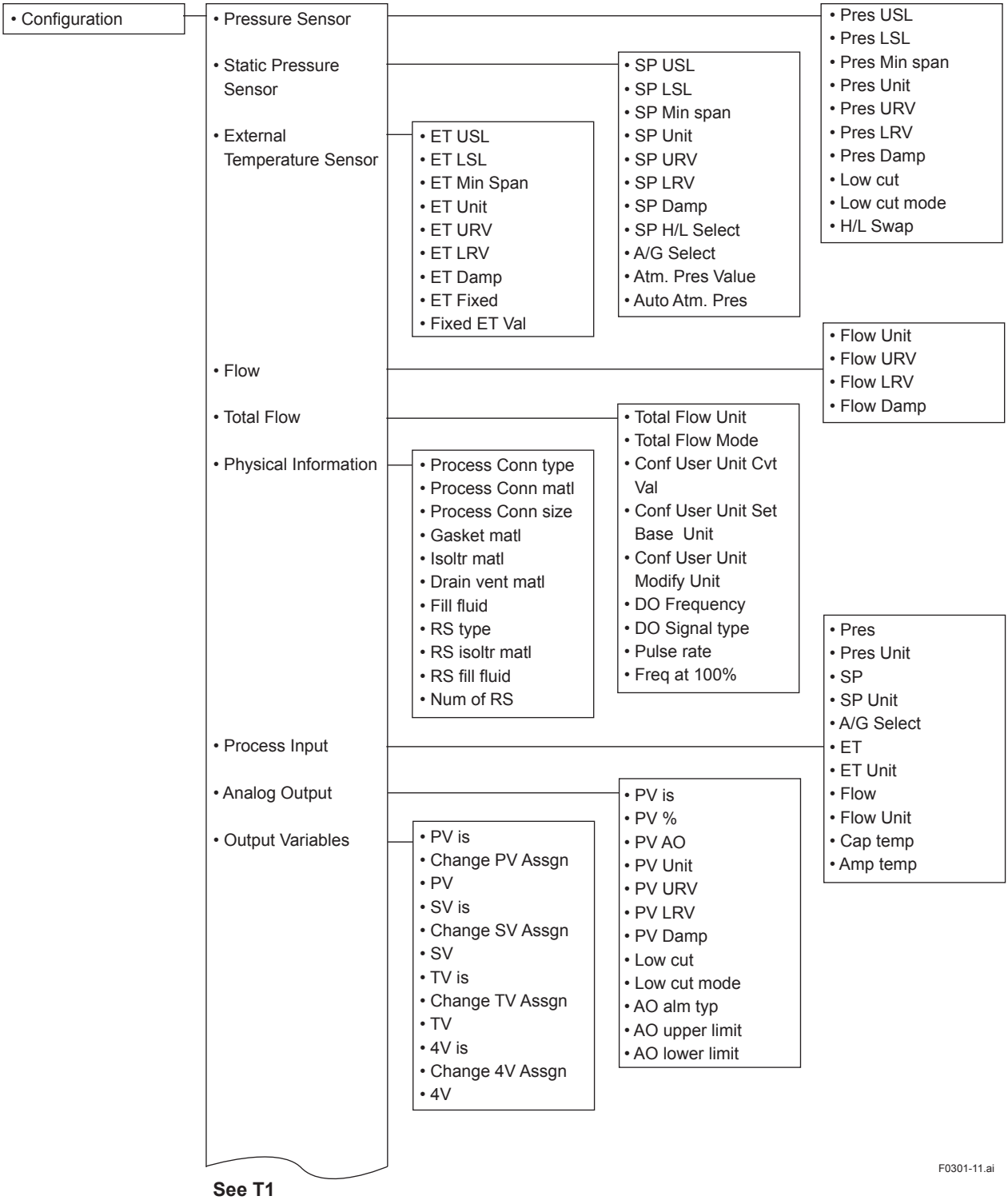


S

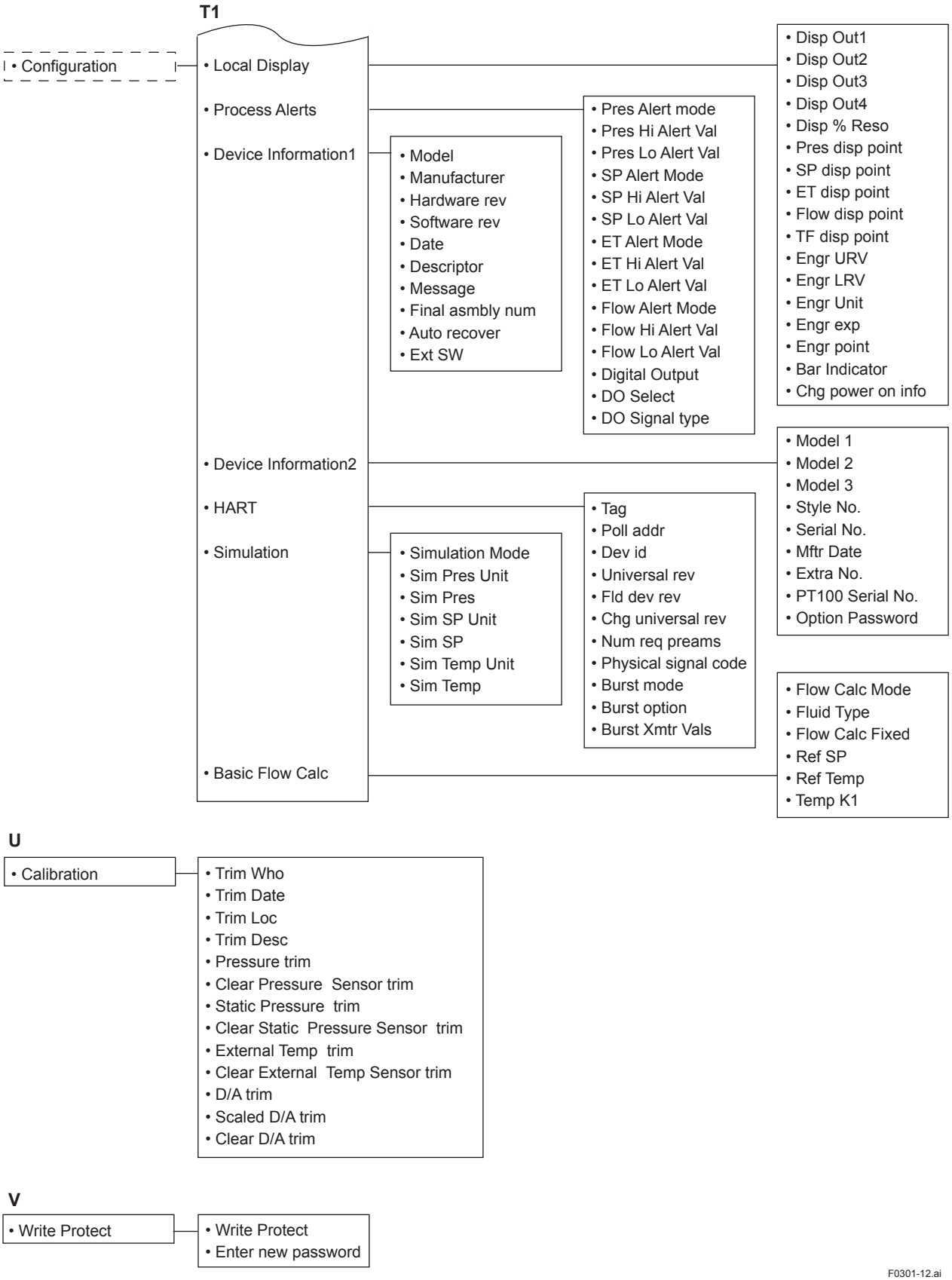


F0301-10.ai

T



See T1 (next page)


T1
• Configuration
• Local Display
• Process Alerts
• Device Information1
• Device Information2
• HART
• Simulation
• Basic Flow Calc
• Disp Out1
• Disp Out2
• Disp Out3
• Disp Out4
• Disp % Reso
• Pres disp point
• SP disp point
• ET disp point
• Flow disp point
• TF disp point
• Engr URV
• Engr LRV
• Engr Unit
• Engr exp
• Engr point
• Bar Indicator
• Chg power on info
• Model
• Manufacturer
• Hardware rev
• Software rev
• Date
• Descriptor
• Message
• Final asmbly num
• Auto recover
• Ext SW
• Pres Alert mode
• Pres Hi Alert Val
• Pres Lo Alert Val
• SP Alert Mode
• SP Hi Alert Val
• SP Lo Alert Val
• ET Alert Mode
• ET Hi Alert Val
• ET Lo Alert Val
• Flow Alert Mode
• Flow Hi Alert Val
• Flow Lo Alert Val
• Digital Output
• DO Select
• DO Signal type
• Model 1
• Model 2
• Model 3
• Style No.
• Serial No.
• Mftr Date
• Extra No.
• PT100 Serial No.
• Option Password
• Tag
• Poll addr
• Dev id
• Universal rev
• Fld dev rev
• Chg universal rev
• Num req preams
• Physical signal code
• Burst mode
• Burst option
• Burst Xmtr Vals
• Simulation Mode
• Sim Pres Unit
• Sim Pres
• Sim SP Unit
• Sim SP
• Sim Temp Unit
• Sim Temp
• Flow Calc Mode
• Fluid Type
• Flow Calc Fixed
• Ref SP
• Ref Temp
• Temp K1
U
• Calibration
• Trim Who
• Trim Date
• Trim Loc
• Trim Desc
• Pressure trim
• Clear Pressure Sensor trim
• Static Pressure trim
• Clear Static Pressure Sensor trim
• External Temp trim
• Clear External Temp Sensor trim
• D/A trim
• Scaled D/A trim
• Clear D/A trim
V
• Write Protect
• Write Protect
• Enter new password

F0301-12.ai

3.2 Basic Setup

IMPORTANT

After setting and sending data with the HART configuration tool, wait 30 seconds before turning off the transmitter. If it is turned off too soon, the settings will not be stored in the transmitter.

3.2.1 Tag and Device Information

If there are specified when ordering, the desired Tag No. and device information are set and shipped. Tag No. and device information can be checked as follows.

- Procedure to call up the display using DD (HART 5/HART 7) and DTM (HART 7)

Item	Procedure
Tag	**[Root Menu]** → Basic setup → Tag
Long Tag (HART 7 only)	**[Root Menu]** → Basic setup → Long Tag
Descriptor	**[Root Menu]** → Basic setup → Device information → Descriptor
Message	**[Root Menu]** → Basic setup → Device information → Message
Date	**[Root Menu]** → Basic setup → Device information → Date

- Procedure to call up the display using DTM (HART 5)

Item	Procedure
Tag	Easy Setup → Tag or Configuration → HART → Tag
Descriptor	Configuration → Device information 1 → Descriptor
Message	Configuration → Device information 1 → Message
Date	Configuration → Device information 1 → Date

When the Tag No. and device information are changed, input them based on the following limitations.

Item	Limitations
Tag	Up to 8 characters or numbers*1
Long tag (HART 7 only)	Up to 32 characters or numbers*2
Descriptor	Up to 16 characters or numbers*1
Message	Up to 32 characters or numbers*1
Date	mm/dd/yyyy - mm: month (2 digits) - dd: days (2 digits) - yyyy: years (4 digits)

*1: The characters bounded by the thick line in the following table can be used.
*2: All characters in the following table can be used.

SP	!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
p	q	r	s	t	u	v	w	x	y	z	{	|	}	~	

*: SP shows one-byte space

3.2.2 Process Variable Setup

The multivariable transmitter can handle five kinds of Device Variables; differential pressure (DP), static pressure (SP), external temperature (ET), and also flow rate and total flow which are calculated by using these values.

Four data selected from these five data can be assigned to Dynamic Variables; PV (Primary Variable), SV (Secondary Variable), TV (Tertiary Variable) and 4V* (Fourth Variable) or QV* (Quaternary Variable).

Data assigned for PV become the 4 to 20mA current output.

Total flow can not be assigned to PV.
These data are set as follows when the instrument is shipped.

In case of measurement function code is “A” (Multi sensing):
PV: Differential pressure
SV: Static pressure
TV: External temperature
4V/QV*: Flow rate
In case of measurement function code is “B” (Mass flow measurement):
PV: Flow rate
SV: Differential pressure
TV: Static pressure
4V/QV*: External temperature
*: 4V is for HART 5, QV is for HART 7

- Procedure to call up the display using DD (HART 5/HART 7) and DTM (HART 7)

PV related parameter	**[Root Menu]** → Process variables → Output vars → PV →
→ PV is	Current PV value
→ Change PV Assgn	Select the variable assigned to PV (Flow, Pres, SP, ET)
SV related parameter	**[Root Menu]** → Process variables → Output vars → SV →
→ SV is	Current SV value
→ Change SV Assgn	Select the variable assigned to SV (Flow, Pres, SP, ET, Total Flow)
TV related parameter	**[Root Menu]** → Process variables → Output vars → TV →
→ TV is	Current TV value
→ Change TV Assgn	Select the variable assigned to TV (Flow, Pres, SP, ET, Total Flow)
4V/QV related parameter	**[Root Menu]** → Process variables → Output vars → 4V/QV →
→ 4V is / QV is	Current 4V/QV value
→ Change 4V Assgn /Change QV Assgn	Select the variable assigned to 4V/QV (Flow, Pres, SP, ET, Total Flow)

- Procedure to call up the display using DTM (HART 5)

PV related item	Configuration → Output Variables →
→ PV is	Current PV value
→ Change PV Assgn	Select the variable assigned to PV (Flow, Pres, SP, ET)
It is similar about SV, TV and 4V. The process variables that can be assigned are Flow, Pres, SP, ET, and Total Flow.	

3.2.3 Measuring Range

This section shows how to confirm and change the parameters for measuring range of flow rate, differential pressure, static pressure, external temperature, and total flow, and also unit and damping time constant.

These parameters are set at the factory before shipment if specified at the time of order.

Follow the procedure below to change them.

About the differential pressure, static pressure and external temperature, settable range are shown on the parameters of LSL (Lower settable limit), USL (Upper settable limit) and Min span (Minimum span). Set the data within the range.

- Procedure to call up the display

Call up and setting of flow related parameters	
DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Signal condition → Flow Setup →
DTM (HART 5)	Configuration → Flow →
→ Flow LRV	Lower range value for flow
→ Flow URV	Upper range value for flow
→ Flow Unit	Unit for flow
→ Flow Damp	Damping time constant for flow

Call up and setting of differential pressure related parameters	
DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Signal condition → DP Setup (or Pres Setup) →
DTM (HART 5)	Configuration → Pressure Sensor →
→ Pres LRV	Lower range value for differential pressure
→ Pres URV	Upper range value for differential pressure
→ Pres Unit	Unit for differential pressure
→ Pres Damp	Damping time constant for differential pressure

Call up and setting of static pressure related parameters	
DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Signal condition → SP Setup →
DTM (HART 5)	Configuration → Static Pressure Sensor →
→ SP LRV	Lower range value for static pressure
→ SP URV	Upper range value for static pressure
→ SP Unit	Unit for static pressure
→ SP Damp	Damping time constant for static pressure

Call up and setting of external temperature related parameters	
DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Signal condition → ET Setup →
DTM (HART 5)	Configuration → External Temperature Sensor →
→ ET LRV	Lower range value for external temperature
→ ET URV	Upper range value for external temperature
→ ET Unit	Unit for external temperature
→ ET Damp	Damping time constant for external temperature

Call up and setting of total flow related parameters	
DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Signal condition → Total Flow →
DTM (HART 5)	Configuration → Total Flow →
→ Total Flow Unit	Unit for total flow

NOTE

The calibration range can be set as PV LRV > PV URV under the following conditions, reversing the 4 to 20 mA output signal.
PV LSL -10% of USL ≤ PV LRV ≤ PV USL +10% of USL
PV LSL -10% of USL ≤ PV URV ≤ PV USL +10% of USL
|PV URV - PV LRV| ≥ PV Min. Span

If PV is flow, PV LRV and PV URV must be the following conditions.
0 ≤ PV LRV
0 ≤ PV URV
PV LRV < PV URV

The flow range is set to LRV=0 and URV=100 when the Flow calc mode is changed to Basic mode or Full Auto mode.

If PV is ET, PV LRV and PV URV must be the following conditions.
-210°C ≤ PV LRV ≤ 860°C (-346°F ≤ PV LRV ≤ 1580°F)
-210°C ≤ PV URV ≤ 860°C (-346°F ≤ PV URV ≤ 1580°F)
|PV URV - PV LRV| ≥ PV Min. Span

3.2.4 Units

Refer to the subsection 3.2.3 to call up the display. Select the unit from displayed list as shown below.

(1) Unit list of differential pressure

mmH2O, mmH2O@68degF, mmHg, Torr, MPa, kPa , Pa, mbar , bar , gf/cm2, kgf/cm2, inH2O, inH2O@68degF, inHg, ftH2O, ftH2O@68degF, psi, atm, hPa

Note that the Yokogawa default setting for the standard temperature is 4°C (39.2°F). For the units of mmH_2O, inH_2O, and ftH_2O, the pressure varies according to the standard temperature definition. Select the appropriate unit with @68degF when a standard temperature of 20°C (68°F) is required.

(2) Unit list of static pressure

mmH2O, mmH2O@68degF, mmHg, Torr, MPa, kPa , Pa, mbar , bar , gf/cm2, kgf/cm2, inH2O, inH2O@68degF, inHg, ftH2O, ftH2O@68degF, psi, atm, hPa

(3) Unit list of temperature

degC , degF, Kelvin*

*: In the case of using DTM(HART 7), it is displayed as "K".

(4) Unit list of flow

Mass Flow	g/s, g/min, g/h, kg/s, kg/min, kg/h, kg/d, t/min, t/h, t/d, lb/s, lb/min, lb/h, lb/d, STon/min, STon/h, STon/d, LTon/h, LTon/d
Normal/ Standard Volume Flow	Nm3/h, NL/h, SL/h, SL/min, SL/s, Nm3/d, SCFD, SCFH, SCFM, SCFS, Sm3/d, Sm3/h, MSCFD, MMSCFD
Volume Flow	CFM, GPM, L/min, Impgal/min, m3/h, gal/s, Mgal/d, L/s, ML/d, CFS, ft3/d, m3/s, m3/d, Impgal/h, Impgal/d, CFH, m3/min, bbl/s, bbl/min, bbl/h, bbl/d, gal/h, Impgal/s, L/h, gal/d

(5) Unit list of total flow

g, kg, t, lb, Ston, Lton, oz, gal, L, Impgal, m3, bbl, yd3, ft3, in3, Nm3, NL, SCF, Spcl*

* The user unit is displayed on LCD.
To configure the user unit, refer to subsection 3.3.5.

3.2.5 Damping Time Constant Setup

Any number from 0.00 to 100.00 can be set for the amplifier damping time constant of process variables.

Refer to subsection 3.2.3 to call up the display.

Damping time constant is set as shown in the following table at the factory when the instrument is shipped, but in case of the option code /CA is specified, the damping time constant is set as specified in the order.

Process variables	Factory default value
Differential pressure	2sec
Static pressure	1sec
External temperature	2sec
Flow rate	0sec

NOTE

- When the HART communication is used under the condition of quick output change, set the damping time constant more than 0.5 sec.
- The damping time constant for the amplifier assembly can be set here. The damping time constant for the entire transmitter is the sum of the values for the amplifier assembly and the capsule assembly.
  About the value for the capsule assembly, refer to the User's Manual for EJX910/ EJX930 (IM 01C25R01-01E) or General Specifications (GS 01C25R01-01EN, GS 01C25R04-01EN).

3.2.6 Differential Pressure Signal Low Cut Mode Setup

Low cut mode can be used to stabilize the differential pressure output signal near the zero point. The Low cut is applied to the differential pressure used to flow calculation. The low cut point can be set from 0 to 20% of output. (Hysteresis for the cut point: ±10% of the cut point)

Follow the procedure below to change the Low cut mode and Low cut point.

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Basic setup → Others →
DTM (HART 5)	Configuration → Analog Output →
→ Low cut	Set from 0 to 20% of output
→ Low cut mode	Select “On” or “Off”

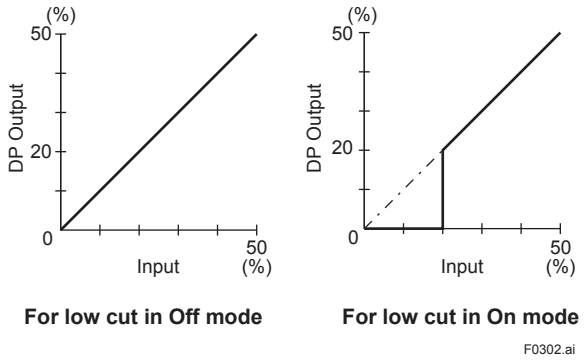


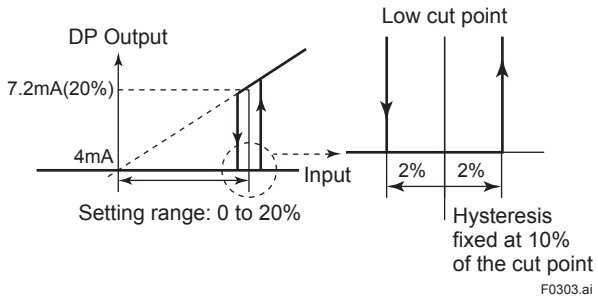
Figure 3.1 Low Cut Mode

The low cut point has hysteresis so that the output around the point is behaved as below figure.

<Example>

Low cut mode: On

Low cut: 20.00%



3.2.7 Impulse Line Connection Orientation Setup

This function reverses the impulse line orientation. This function is used when the high pressure side impulse line and the low pressure side impulse line are connected reverse by mistake.

Follow the procedure below to assign the high pressure impulse line to the L side of the transmitter.

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Basic setup → Others →
DTM (HART 5)	Configuration → Pressure Sensor →
→ H/L Swap	Select “Normal” or “Reverse”

3.3 Detailed Setup

3.3.1 Analog Output Signal Adjustable Range

Output signal adjustable range at normal operating condition are set as shown below at the factory when the instrument is shipped, and output signal are limited by these value.

	Lower limit	Upper limit
Standard Option code /C1	3.8 mA	21.6 mA
Option code /C2 and /C3	3.8 mA	20.5 mA

Output signal range can be changed between 3.8mA and 21.6mA to match it to the equipment on the receiving side.
Lower value is set at **AO lower limit** and upper value is set at **AO upper limit** respectively.
Follow the procedure below to change the upper and lower values.

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Output condition → Analog output →
DTM (HART 5)	Configuration → Analog output →
→ AO lower limit	Set the lower value (mA)
→ AO upper limit	Set the upper value (mA)

Set the values as below.
Lower value < Upper value

3.3.2 Static Pressure Setup

(1) Selection of Gauge pressure and Absolute pressure

Either the gauge pressure or absolute pressure can be selected to display on the LCD display.
Absolute pressure is selected when the instrument is shipped.

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Signal condition → SP Setup →
DTM (HART 5)	Configuration → Static Pressure Sensor →
→ A / G Select	Select “Gauge” or “Absolute”

(2) Selection of pressure side

Either the high or low pressure side of capsule can be selected to monitor the static pressure.
High pressure side is selected when the instrument is shipped.

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Signal condition → SP Setup →
DTM (HART 5)	Configuration → Static Pressure Sensor →
→ SP H/L Select	Select “High” or “Low”

3.3.3 External Temperature Fixation Mode

The external temperature can be fixed with this mode. The parameter setting to enter the Fixation Mode when the RTD sensor is disconnected is also possible.

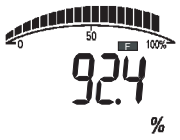
- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Signal condition → ET Setup → Fixed ET →
DTM (HART 5)	Configuration → External Temperature Sensor →
→ ET Fixed	Select “No”, “Yes” or “FALL BACK” No: Shows process temperature value Yes: Fix the temperature value FALL BACK: Fix the temperature value when the RTD sensor is disconnected.
→ Fixed ET Val	Set the fixed temperature value

3.3.4 Integral Indicator Scale Setup

The following seven displays are available for integral indicator. A cycle of up to four displays can be shown by assigning variables to the parameters at **Disp select**.

- % of PV range
- Flow rate
- Input differential pressure
- Input static pressure
- Input external temperature
- User set scaled PV
- Total flow

Available displays	Description and related parameters
% of PV range (PV %) 	Indicates input value depending on the set PV range (**PV LRV** and **PV URV**). PV % 92.4 %
Flow rate (Flow)	Indicates values of calculated flow with the indication limits –99999 to 99999. Flow 26.0 kg/h
Input differential pressure (Pres)	Indicates values of input differential pressure with the indication limits –99999 to 99999. PRES 45.6 kPa
Input static pressure (SP)	Indicates values of input static pressure with the indication limits –99999 to 99999. SP 6.178 MPa
Input ext. temperature (ET)*1	Indicates values of input external temperature with the indication limits –99999 to 99999. ET 22.95 degC
User set scaled PV (Engr Disp)*2	Indicates values depending on the engineering range (**Engr LRV** and **Engr URV**) with the unit (**Engr Unit**). Engr LRV 0.0 Engr URV 45.0 Engr exp x100 Engr Unit m3/min Engr point 1
Total flow (Total Flow)*3	Indicates values of calculated total flow with the indication limits as follows. 0 to 9.99E29 (Normal mode) 0 to 999999 (Cyclic mode) Total Flow 123.45 kg

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*1 : “EXT. TEMP” for DD and DTM (HART 5)
*2 : “ENGR. PV” for DD and DTM (HART 5)
*3 : “TOTAL FLOW” for DD and DTM (HART 5)

See (a) through (d) for the setting procedures.

a. Display Selection

At **Disp select**, select the variable that the parameter Disp 1 will display on the integral indicator.

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Display condition → Disp select → Disp 1
DTM (HART 5)	Configuration → Local Display → Disp Out 1
→ Disp 1 / Disp Out 1	Select desired display from seven kinds of displays shown above.

Set Disp 2, Disp 3 and Disp 4 in the same way if necessary.
In addition to the above item, "Not used" is also displayed as a selection item.

b. Cyclic Display

Up to four displays can be displayed cyclically in the order of the parameter number.

c. Display Resolution

User can change the position of decimal point which is shown on the integral indicator.

- Procedure to call up the **Disp % reso** display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Display condition →
DTM (HART 5)	Configuration → Local Display →
→ Disp % Reso	Select the decimal point position of PV% Normal: Display one digit below the decimal point High Resolution: Display two digits below the decimal point

- Procedure to call up the **Flow Disp point** , **Pres disp point** , **SP disp point** , **ET disp point** , **TF disp point** display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Display condition → Disp Condition →
DTM (HART 5)	Configuration → Local Display →
→ Flow Disp point	Select the decimal point position of flow rate (0, 1, 2, 3 or 4)
→ Pres disp point	Select the decimal point position of differential pressure (0, 1, 2, 3 or 4)
→ SP disp point	Select the decimal point position of static pressure (0, 1, 2, 3 or 4)
→ET disp point	Select the decimal point position of external temperature (0, 1, 2, 3 or 4)
→TF disp point	Select the decimal point position of total flow (0, 1, 2, 3 or 4)

d. User Setting of Engineering Unit and Scale

[For DD (HART 5/7) and DTM (HART 7)]
Engr disp range parameters allow the engineering unit and scale to be displayed. At **Set Engr Unit**, the following engineering units can be selected from a list.

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Display condition → Engr disp range
→ Set Engr Unit	Select the engineering unit
→ Engr LRV	Lower range value
→ Engr URV	Upper range value
→ Engr exp	Exponents for user scale display
→ Engr point	Decimal point position for user scale display

Select the engineering unit from the list. Available units are shown below

kPa	ftH_2O	Nl/min
MPa	gf/cm^2	Nm^3/h
mbar	kgf/cm^2	Nm^3/min
bar	kg/cm^2G	ACFH
psi	kg/cm^2A	ACFM
psia	atm	CFH
mmH_2O	kg/h	SCFM
mmHg	t/h	GPH
mmHgA	m^3/h	GPM
mmAq	m^3/min	m
mmWG	l/h	mm
Torr	l/min	in
inH_2O	kl/h	ft
inHg	kl/min	kg/m^3
inHgA	Nl/h	g/cm^3

At **Modify Engr Unit** parameter, user can set your own unit also.
Up to eight alphanumeric characters, spaces or one slashe (/) can be input at **Modify Engr Unit**; only the first six are displayed on the integral indicator.

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Display condition → Engr disp range →
→ Modify Engr Unit	Set your own unit

Note that following symbols are not available:

% & < > . * : + - , ’ ( )

The integral indicator shows “-- -- -- -- --” when these symbols or more than two slashes are entered.

[For DTM (HART 5)]
User can input the desired unit at **Engr Unit**.

- Procedure to call up the display

DTM (HART 5)	Configuration →Local Display →
→ Engr Unit	Set the engineering unit
→ Engr LRV	Lower range value
→ Engr URV	Upper range value
→ Engr exp	Exponents for user scale display
→ Engr point	Decimal point position for user scale display

Available characters and symbols for **Engr Unit** are the same as for **Modify Engr Unit** shown above.

3.3.5 Total Flow Setup

(1) Mode setting

Set the parameters to start, stop, and reset the total flow.

To start the total flow measurement by normal mode, call up the **Total Flow Mode** display and set the mode.

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Signal condition → Total Flow → Total Flow Mode →
DTM (HART 5)	Configuration → Total Flow → Total Flow Mode →
Reset	Reset the total flow value
Start	Start the total flow measurement. Total value is limited at 9.99E29.
Stop	Stop the total flow measurement
Start Cyclic	Start the total flow measurement. When the total flow value reaches 999999, the count restarts at 0.

(2) User unit configuration

You can set your own unit for total flow.
Select the Base Unit as an base unit, then set the Cvt Val for the conversion coefficient with the user unit.

- Procedure to call up the display for DD (HART 5/HART 7) and DTM (HART 7)

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Signal condition → Total Flow → Config User Unit →
→ Set Base Unit	Select the Base Unit from the list
→ Modify Unit	Set the special total flow unit
→ Cvt Val	Enter the conversion value

- Procedure to call up the display for DTM (HART 5)

DTM (HART 5)	Configuration → Total Flow →
→ Conf User Unit Set Base Unit	Select the Base Unit from the list
→ Conf User Unit Modify Unit	Set the special total flow unit
→ Conf User Unit Cvt Val	Enter the conversion value

Base Unit

g	oz	yd3
kg	gal	ft3
t	L	in3
lb	Impgal	Nm3
STon	m3	NL
LTon	bbl	SCF

Typical Unit Conversion Factor

Use “kg” in case of mass flow
Use “m3” in case of volume flow
Use “Nm3” in case of normal or standard volume flow

Set Base Unit	User Unit	Convert val
kg	g	1.0000E+03
	kg	1.0000E+00
	t	1.0000E-03
	lb	2.2046E+00
	STon	1.1023E-03
	LTon	9.8421E-04
	oz	3.5274E+01
m3	gal	2.6417E+02
	L	1.0000E+03
	Impgal	2.1997E+02
	m3	1.0000E+00
	bbl	6.2898E+00
	bushel	2.8378E+01
	yd3	1.3080E+00
	ft3	3.5315E+01
	in3	6.1024E+04
	bbl	6.2898E+00
	hl	1.0000E+01
Nm3	Nm3	1.0000E+00
	NL	1.0000E+03
	SCF	3.5315E+01

<Example>
Set the special total flow unit as g (=0.001kg) based kg.
(1kg=1.0000E+03g)

1) Select “kg” for **Set base unit** (or **Conf User Unit Set Base Unit**).
2) Set “g” for **Modify Unit** (or **Conf User Unit Modify Unit**).
3) Enter 1.0000E+03 for Cvt Val (or Conf User Unit Cvt Val).

NOTE

Up to eight alphanumeric characters, spaces or slash(/) can be input for **Modify Unit** (or **Conf User Unit Modify Unit**).

3.3.6 Sensor Trim

EJX multivariable transmitter is factory characterized. Factory characterization is the process of comparing a known pressure input with the output of each transmitter sensor module over the entire pressure and temperature operating range. During the characterization process, this comparison information is stored in the transmitter EEPROM. In operation, the transmitter uses this factory-stored curve to produce a process variable output (PV), in engineering units, dependent on the pressure input.

The sensor trim procedure allows you to adjust for local conditions, changing how the transmitter calculates process variables. There are two ways to trim the sensor: a zero trim and a full sensor trim. A zero trim is a one-point adjustment typically used to compensate for mounting position effects or zero shifts caused by static pressure. A full sensor trim is a two-point process, in which two accurate end-point pressures are applied (equal to or greater than the range values), and all output is linearized between them.

Full Sensor Trim—Auto Trim and Manual Trim

Full sensor trim is carried out by performing **Auto, Lower Pt** followed by **Auto, Upper Pt**.

Also, you can manually perform the trimming procedure with **Manual, Lower Pt** and **Manual, Upper Pt**.

The full sensor trim is a two-point adjustment, and the lower point adjustment should always be performed before the upper point adjustment in order to maintain the pitch between the zero and 100% points within the calibration range.

In the manual method, the reference pressure should also be applied to the transmitter at both the lower and upper points. Without the reference pressure, **Manual, Lower Pt** and **Manual, Upper Pt** may not represent the correct value for each adjustment point.

(1) Auto Sensor Trim

Applying reference pressure of 0% and 100% of the measurement range to the transmitter, adjust the lower and upper points automatically.

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Calibration → Pres sensor trim → Pres trim →
DTM (HART 5)	Calibration → Pressure trim →
→ Auto, Lower Pt	Auto trim for 0% point
→ Auto, Upper Pt	Auto trim for 100% point

(2) Manual Sensor Trim

Using the example below, follow the steps to perform the full sensor trim by manually. The Pres LTD (Manual, Lower Pt) and Pres UTD (Manual, Upper Pt) represent the previously adjusted values.

Example: For the range of 1000 to 3000 mmH_2O
Pres LTD (Manual, Lower Pt) = −4.0 mmH_2O
Pres UTD (Manual, Upper Pt) = −3.0 mmH_2O

<1> Call up the **Manual, Lower Pt**.

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Calibration → Pres sensor trim → Pres trim →
DTM (HART 5)	Calibration → Pressure trim →
→ Manual, Lower Pt	Manual trim for 0% point
→ Manual, Upper Pt	Manual trim for 100% point

<2> Suppose that a standard pressure of 1000 mmH_2O is applied and the value of the "Pres for trim" is 994.0. Correct for this output error of 6 mmH_2O by adding 6 mmH_2O to **Pres LTD (Manual, Lower Pt)**.

−4.0+6.0=+2.0

<3> Enter the correction value of "2" to the **Pres LTD (Manual, Lower Pt).**

<4> Call up the **Pres UTD (Manual, Upper Pt).**

<5> Suppose that a standard pressure of 3000 mmH_2O is applied and the value of the Pres for trim is 3015.0. Firstly, obtain the slope error for the span as follows;

$$\text{Slope Error} = \frac{\text{Applied Pressure Value} - \text{Value of Pres for Trim}}{\text{Applied Pressure Value}} \times (\text{URV} - \text{LRV})$$

$$= \frac{3000-3015}{3000} \times (3000-1000) = -10$$

Then correct for this slope error of −10 by adding −10 to **Pres UTD (Manual, Upper Pt)**.

−3.0+(−10.0)=−13.0

<6> Enter the correction value of "−13" to the **Pres UTD (Manual, Upper Pt).**

(3) Sensor Trim for Static Pressure or External Temperature

For the EJX multivariable transmitter, full sensor trim of the static pressure or external temperature is performed in the same way as with the differential pressure.

- Procedure to call up the display for static pressure

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Calibration → SP sensor trim → SP trim →
DTM (HART 5)	Calibration → Static Pressure trim →
→ Auto, Lower Pt	Auto trim for 0% point
→ Auto, Upper Pt	Auto trim for 100% point
→ Manual, Lower Pt	Manual trim for 0% point
→ Manual, Upper Pt	Manual trim for 100% point

- Procedure to call up the display for external temperature

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Calibration → ET Sensor trim → ET trim →
DTM (HART 5)	Calibration → External Temp trim →
→ Auto, Lower Pt	Auto trim for 0% point
→ Auto, Upper Pt	Auto trim for 100% point
→ Manual, Lower Pt	Manual trim for 0% point
→ Manual, Upper Pt	Manual trim for 100% point

(4) Reset Trim Adjistment to Factory Setting

The **Clear P trim, Clear SP trim** and **Clear ET trim** commands can reset the trim adjustment to the initial calibrated values that were set. The amount of the adjustment performed with the external zero-adjustment screw is returned to the initial setting as well.

- Procedure to call up the display for differential pressure

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Calibration → Pres Sensor trim → Clear P trim → Execute
DTM (HART 5)	Calibration → Clear Pressure Sensor trim → Execute

- Procedure to call up the display for static pressure

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Calibration → SP Sensor trim → Clear SP trim → Execute
DTM (HART 5)	Calibration → Clear Static Pressure Sensor trim → Execute

- Procedure to call up the display for external temperature

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Calibration → ET Sensor trim → Clear ET trim → Execute
DTM (HART 5)	Calibration → Clear External Temp Sensor trim → Execute

3.3.7 Trim Analog Output

Fine current output adjustment is carried out with **D/A trim** or **Scaled D/A trim**.

(1) D/A Trim

D/A trim is to be carried out if the calibration digital ammeter does not exactly read 4.000 mA and 20.000 mA with an output signal of 0% and 100%.

- Procedure to call up the **D/A trim** display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Calibration → Analog output trim → D/A trim
DTM (HART 5)	Calibration → D/A trim

(2) Scaled D/A Trim

Scaled D/A trim is to be carried out if the output is adjusted using a voltmeter or a meter whose scale is 0 to 100%.

- Procedure to call up the **Scaled D/A trim** display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Calibration → Analog output trim →Scaled D/A trim
DTM (HART 5)	Calibration → Scaled D/A trim

<Example>

Adjustment using a volt meter. (4mA → 1V, 20mA → 5V)

1) Select “Change”.
2) Enter the value read on the voltmeter when the output signal is 4mA.
   In this case, enter the value of the voltage across a 250Ω resistor (1V).
3) Enter the value read on the meter when the output signal is 20mA (5V).
4) Select “Proceed”.
5) Connect the voltmeter.
6) Output the 0% output signal and read the output value.
7) Enter the reading of the voltmeter to the configuration tool. (The output of the transmitter changes).
8) Confirm the voltmeter reading is 1.000.
9) If the reading on the voltmeter is 1.000, select “Yes”.
   If the reading is not 1.000, select “No” and repeat steps 6 and 7 until the voltmeter reads 1.000V.
10) Output the 100% output signal and read the output value.
11) Enter the reading of the voltmeter.
12) Confirm the voltmeter reading is 5.000.
13) If the reading of the voltmeter is 5.000, select “Yes”.
    If the reading on the voltmeter is not 5.000, select “No” and repeat steps 10 and 11 until the voltmeter reads 5.000V.

3.3.8 External Switch Mode

Follow the procedure below to enable or inhibit zero point adjustment by means of the zero-adjustment screw on the transmitter.

This is set to “Disabled” when the instrument is shipped.

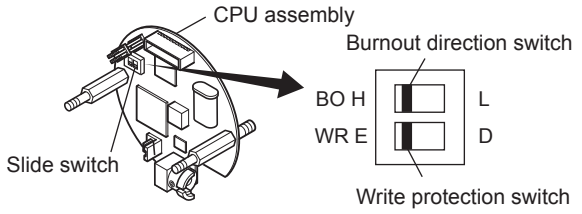
To change the mode, follow the procedure below.

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Device information → Field device info → Ext SW
DTM (HART 5)	Configuration → Device information1 → Ext SW
Enabled	Enable the external zero point adjustment
Disabled	Disable the external zero point adjustment

3.3.9 CPU Failure Burnout Direction and Hardware Write Protect

There are two slide switches on the CPU assembly board. One sets the burnout direction at CPU failure, and the other sets a write protection function which disables parameter changes through the use of a handheld terminal or some other communication method.



Burnout direction switch (BO)		
Burnout Direction Switch Position	H L E D	H L E D
Burnout Direction	HIGH	LOW

Hardware write protection switch (WR)		
Write Protection Switch Position	H L E D	H L E D
Write Protection	NO (Write enabled)	YES (Write disabled)

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The parameter of **AO alm typ** parameter displays the status of 4-20 mA DC output if a CPU failure occurs. In case of a failure, communication is disabled.

Standard specifications or with option code /C3
The burnout direction switch is set to “HIGH”. If a failure occurs, the transmitter outputs a 110% or higher signal.

With option code /C1 or /C2
The burnout direction switch is set to “LOW”. If a failure occurs, a –2.5% or lower output is generated.

To confirm the burnout direction at the CPU failure, follow the procedure below.

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Output condition → Analog output → AO alm typ
DTM (HART 5)	Configuration → Analog output → AO alm typ
High	Burnout direction is set to High
Low	Burnout direction is set to Low

3.3.10 Software Write Protection

EJX multivariable transmitter configured data is saved by using a write protection function. The write protection status is set to “Yes” when 8 alphanumeric characters are entered in the **New password** field and transferred to the transmitter.

When write protection is set to ”Yes,” the transmitter does not accept parameter changes. When the same eight alphanumeric string entered in the **New password** field is also entered in the **Enable wrt 10min** field and transferred to the transmitter, it will be possible to change transmitter parameters during a 10 minute period.

To change the transmitter from the write protection ”Yes” status back to write protection ”No” status, use **Enable wrt 10min** to first release the write protection function and then enter eight spaces in the **New password** field.

- Procedure to call up the display using DD (HART 5/HART 7) and DTM (HART 7)

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Device information → Field device info → Wrt protect menu →
→ Write Protect	Display current protect mode (Yes: protected, No: not protected)
→ Enable wrt 10 min	Release the protect function for 10 min.
→ New password	Set the new password or change the password

- Procedure to call up the display using DTM (HART 5)

DTM (HART 5)	Write Protect →
→ Write Protect	Display current protect mode (Yes: protected, No: not protected)
→ Enter new password	Enter the password here to enable the protect function. Enter eight spaces to disable the protect function.
→ Enable write	Enter the password here to release the protect function for 10 min.

3.3.11 Alarm

The function is used to display the alarm codes when the input differential pressure exceeds the specified value within the calibration range. The same is available for the input static pressure, external temperature, and flow rate. Refer to table 4.5 Alarm Message Summary for the specific alarm code to be generated.

(1) Alarm Setting

Select the process variable at **Process Alert** which the alarm is set, then set the alert mode for that value.

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Output condition → Process Alerts →
DTM (HART 5)	Configuration → Process Alerts →
Selection of the process variable for alarm	→ Pres Alert Mode: Differential pressure
	→ SP Alert Mode: Static pressure
	→ ET Alert Mode: External temperature
	→ Flow Alert Mode: Flow rate
Selection of alert mode	Off: Disable the alert function
	Hi Al Detect: High side alert detection
	Lo Al Detect: Low side alert detection
	Hi/Lo Al Detect: High and Low side alert detection

(2) Threshold Level Setting

Set the threshold of high and low alert value for alarm generation.

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Output condition → Process Alerts →
DTM (HART 5)	Configuration → Process Alerts →
Parameter	Detail
→ Pres Hi Alert Val	Set the threshold value of upper side for differential pressure
→ Pres Lo Alert Val	Set the threshold value of lower side for differential pressure
→ SP Hi Alert Val	Set the threshold value of upper side for static pressure
→ SP Lo Alert Val	Set the threshold value of lower side for static pressure
→ ET Hi Alert Val	Set the threshold value of upper side for external temperature
→ ET Lo Alert Val	Set the threshold value of lower side for external temperature
→ Flow Hi Alert Val	Set the threshold value of upper side for flow rate
→ Flow Lo Alert Val	Set the threshold value of lower side for flow rate

3.3.12 Status Output and Pulse Output

EJX multivariable transmitter has a contact output. Select the type of output, status output or pulse output, and set the unit, value etc.

(1) Selecting of output signal

Status output or pulse output can be selected for the contact output.

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Output condition → Process Alerts → DO config → DO Signal type	
DTM (HART 5)	Configuration → Process Alerts → DO Signal type	
Status Output	On When Al. Detect	Output is “ON” when alert is detected
	Off When Al. Detect	Output is “OFF” when alert is detected
Pulse Output	Scaled Pulse	Scaled pulse output
	Frequency	Frequency output

<Example>

Set the status output to output an off signal when the input pressure exceeds 75 kPa with the alert mode of Hi. Al Detect.

1) Select “Off When Al. Detect”
2) Select “Pres Alert Mode: Differential pressure” (Refer to subsection 3.3.11(1) Alarm Setting)
3) Select “Hi Al Detect: High side alert detection” (Refer to subsection 3.3.11(1) Alarm Setting)
4) Enter “75kPa” to **Pres Hi Alert Val** (Refer to subsection 3.3.11(2) Threshold Level Setting)

CAUTION

Whenever turning on the transmitter or detecting the short interruption, check if contact output correctly reflects the alarm status and test the ON/OFF action of contact output by the parameter **DO test** to confirm that the contact output operates correctly.

(2) Setting of status output

This feature is used for a transistor output (open collector) of an on/off signal according to the status of high and low alarm limits, which are user-configurable values as shown in subsection 3.3.11 Alarm. The status output can be assigned as any combination of the high or low limits of the input pressure, input static pressure, external temperature, or flow.

• Procedure to call up the display

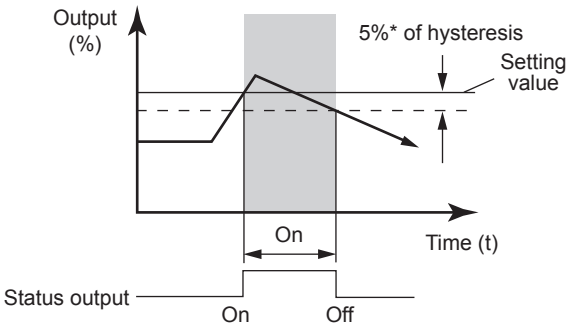
DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Output condition → Process Alerts → DO config → DO Select
DTM (HART 5)	Configuration → Process Alerts → DO Select
Display Item	Contents (Select a output variable from the list below)
Off	–
Pres	Differential pressure
SP	Static pressure
Temp	External temperature
Pres/SP	Differential pressure and static pressure
Pres/Temp	Differential pressure and external temperature
SP/Temp	Static pressure and external temperature
Pres/SP/Temp	Differential pressure, static pressure and external temperature
Flow	Flow rate
Pres/Flow	Differential pressure and flow rate
SP/Flow	Static pressure and flow rate
Temp/Flow	External temperature and flow rate
Pres/SP/Flow	Differential pressure, static pressure and flow rate
Pres/Temp/Flow	Differential pressure, external temperature and flow rate
SP/Temp/Flow	Static pressure, external temperature and flow rate
Pres/SP/Temp/Flow	Differential pressure, static pressure, external temperature and flow rate
Diag Alarm	Alarm for advanced diagnostics (Refer to subsection 4.2.2.5)
All	Alarm for differential pressure, static pressure, external temperature, flow rate, and advanced diagnostics

NOTE

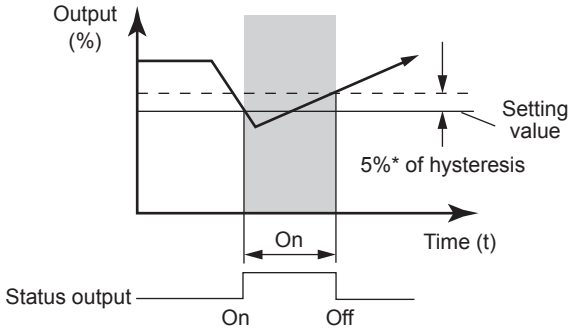
No status output signal has been defined for a CPU failure or hardware error. Use a 4-20 mA signal to indicate a transmitter's failure.

Example: Status output operation of **ON WHEN AL. DETECT**

● Status output for higher alert value



● Status output for lower alert value



*: 5% of setting span for differential pressure / pressure

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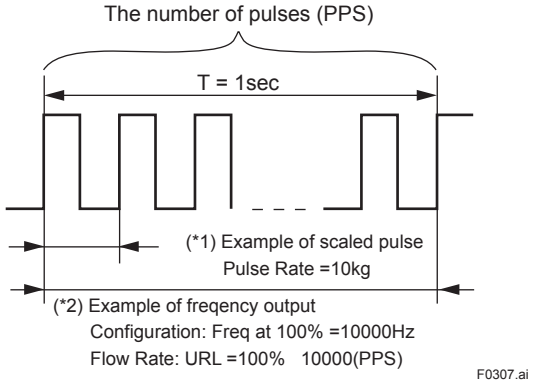
Figure 3.2 Status Output

(3) Setting of pulse output

When the pulse output is used, either scaled pulse output or frequency output is selected in subsection 3.3.12 (1).
Then configure the parameter shown below.

a. Scaled pulse
   A single pulse is output for a specified flow amount.
b. Frequency output
   The flow rate is determined from the number of output pulses per second.

Example of Pulse Output


The number of pulses (PPS)
T = 1sec
(*1) Example of scaled pulse
Pulse Rate =10kg
(*2) Example of freqency output
Configuration: Freq at 100% =10000Hz
Flow Rate: URL =100% 10000(PPS)
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- **Scaled pulse**

• Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Signal condition → Total Flow →
DTM (HART 5)	Configuration → Total Flow →
→ Total Flow Unit	Select the unit of total flow
→ Pulse rate	Set the volumetric flow rate or mass flow rate per one pulse.

<Example>
Scaled pulse 10 kg Set
1) Enter “kg” to **Total Flow Unit**
2) Enter “10” to **Pulse rate**

- **Frequency output**

• Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Signal condition → Total Flow →
DTM (HART 5)	Configuration → Total Flow →
→ Freq at 100%	Set the number of output pulse per second at 100% flow rate. Max. frequency: 10kHz Duty cycle: Approx 50%

<Example>
Freq at 100% is 10000 Hz Set
1) Enter “10000” to **Freq at 100%**

3.3.13 Test Output, Simulation, and Squawk

NOTE

Fixed current output, DO Test, Flow Simulation Mode, and Device Variable Simulation Function continue for a given holding time, then is released automatically. Even if the HART configuration tool power supply is turned off or the communication cable is disconnected, the test output will continue for that time.
The holding time can be selected from 10 min*, 30 min, 60 min, 3 hour, 6 hour or 12 hour.
*: Default value.

• Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Test Auto Release Time
DTM (HART 5)	Diag and Service → Service → Test Auto Release Time

(1) Fixed current output

This feature can be used to output a fixed current for loop checks. The available range for test output depend on the settings for the **AO lower limit** and **AO upper limit** parameters, whose limit is from 3.8mA (-1.25%) to 21.6mA (110%).
Refer to the subsection 3.3.1 about the setting of **AO lower limit** and **AO upper limit**.
While this function works, “TEST” is displayed on the integral indicator.

- **In the case of using DD (HART 5/HART 7) and DTM (HART 7)**

Call up the test output parameter (Loop test) and select the output signal.

• Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Test → Loop test →
Display Item	Contents
4mA	Output a 4mA DC signal
20mA	Output a 20mA DC signal
Other	Set a desired output signal value
End	Exit

- **In the case of using DTM (HART 5)**

Call up the test output parameter (Loop test) and select either manual test or auto test, and set the current value.

• Procedure to call up the display

DTM (HART 5)	Diag and Service → Service → Loop test →
Display Item	Contents
Manual Test	Set the current value or % value at **Test output value**, then click the Start button.
Auto Test	Set the interval and rate of change of current output at **Auto Test Setting**, then click the Start button.

(2) DO Test

This function performs the contact and pulse output test.

• Procedure to call up the display

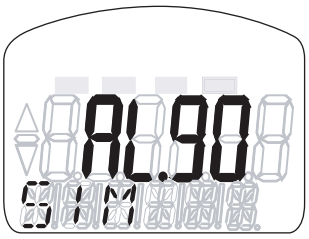
DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Output condition → Process Alerts → DO config → DO Test →
DTM (HART 5)	Diag and Service → Service → DO test →
Display Item	Contents
Status High	Contact output: OFF
Status Low	Contact output: ON
Frequency	Frequency range 0 to 10,000Hz
Exit	Output test is canceled

(3) Flow Simulation Mode

The flow value can be calculated by using pseudo values instead of using actual measurements of differential pressure, static pressure, and external temperature.

This is called “flow simulation mode.”

The output current value becomes the simulation value and the LCD continuously displays the simulation value and alarm (AL.90 SIM) in alternating sequence.



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Select the desired simulation mode from the list below, and set the unit and value.

• Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Simulation/Flow Simulation* →	
DTM (HART 5)	Configuration → Simulation →	
→ Simulation Mode (Select the combination of pseudo variables)	Off:	–
	ON: DP	Differential pressure only
	ON: SP	Static pressure only
	ON: DP SP	Differential pressure and static pressure
	ON: ET	External temperature only
	ON: DP ET	Differential pressure and external temperature
	ON: SP ET	Static pressure and external temperature
	ON: DP SP ET	Differential pressure, static pressure and external temperature
	Check Flow Calc	Differential pressure, static pressure, and external temperature without damping
→ Sim Pres Unit	Select the unit for the differential pressure	
→ Sim Pres	Set the differential pressure value for simulation	
It is similar about SP and ET.		

*: “Simulation” is for HART 5, “Flow Simulation” is for HART 7

NOTE

The output process value while simulation can be monitored by LCD and through communication as follows.

Process value	Output value
DP	Simulation value according to simulation mode
SP	Simulation value according to simulation mode
ET	Simulation value according to simulation mode
Flow Rate	Flow calculation value using the DP, SP, ET simulation value
Total Flow	Flow Rate accumulation value

Following function is reflected to flow calculation while simulation.

Simulation value	Function
DP/SP/ET	Measuring Range (LRV/URV) Alarm Status Output Damping Time*
DP	Low Cut Mode

*: When “Check Flow Calc” is selected, damping is ignored.

If one of the following alarm occurs while simulation, all of the output data are held to the value before alarm occurs.

AL.01 (CAP. ERR)
AL.02 (AMP. ERR)
AL.03 (ET. ERR)

(4) Device Variable Simulation Function (Effective only when setting to HART 7)

Using the simulation function, the output signal can be confirmed by setting any value and status to the selected device variable.
Call up the parameter and follow the message shown.
After completing the step 5, the simulation starts.
Integral indicator shows output and alarm (AL.91) alternately.

- Procedure of device variable simulation

Step 1	Call up the parameter	**[Root Menu]** → Diag/ Service → Test → Simulate
2	Selection of Device Variable	Select one parameter from the list below Off Flow Pres SP ET Total Flow PV SV TV QV % Range Loop Current
3	Setting of Value	Input the simulate value
4	Setting of Data quality	Select one parameter from the list below Bad Poor accuracy Manual / Fixed Good
5	Setting of Limit status	Select one parameter from the list below Not limited Low limited High limited Constant

NOTE

- The flow rate is calculated from differential pressure, static pressure, and external temperature, and the total flow is accumulated from the flow rate. Therefore, the simulation results for the flow rate and total flow depend on the simulation settings of differential pressure, static pressure, and external temperature. The total flow depends on the flow rate as well.
- The total flow simulation is only applied for LCD display and communication output and does not affect the total flow value.
- All the simulations for differential pressure, static pressure, external temperature, flow rate are reflected to the output. Accordingly, the loop current, LCD display, and communication output are directly corresponded to the simulate value. The alarm output is also available according to the simulate value.
- Damping is applicable for differential pressure, static pressure, and external temperature simulation.

(5) Squawk (Effective only when setting to HART 7)

This feature can be used to identify the communicating transmitter by remotely causing LCD to display the particular pattern as shown in the Figure 3.3.
"SQUAWK" continues for approximately 15 seconds, then is released automatically.
Enter the larger number to "Change number of squawks to make" in order to prolong the duration of squawk indication.

- Procedure to call up the **Squawk** display

[Root Menu] → Diag/Service → Test → Squawk

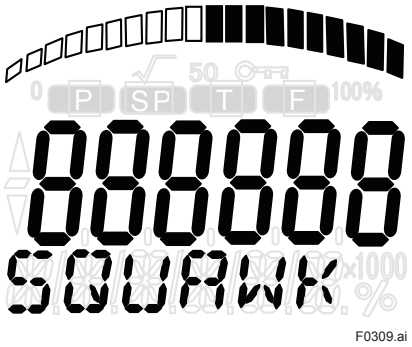

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Figure 3.3 LCD display for Squawk

3.3.14 Basic Flow Calculation (Basic mode)

In the case of Basic mode, flow operation and density compensation are performed conventionally with the flow factors manually input.

The flow rate is calculated using the constant flow factor.

Density is compensated as follows according to the selection of gas or liquid.

Gas: Compensation as ideal gas by temperature and pressure.
Liquid: Compensation by temperature.

There are an automatic compensation mode and basic mode in the flow calculation, and either is selected in the **Flow Calc Mode** parameter.

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Basic Flow Calc → Flow Calc Mode →
DTM (HART 5)	Configuration → Basic Flow Calc → Flow Calc Mode →
Display Item	Contents
Basic Mode	Basic calculation mode
Auto Comp. Mode	Automatic compensation mode (Use FSA120 for this mode)

Select "Basic Mode" here, and set the parameters according to the procedure of Table 3.2.
FSA120 (FieldMate FlowNavigator) can configure both automatic compensation mode and basic mode. For detail, refer to the User's Manual of FSA120 FieldMate FlowNavigator (IM 01C25R51-01E).

Table 3.2 Basic Flow Calc Set-up Steps

Step	Parameter	Contents	Remarks
1	Flow Calc Mode	Select Basic Mode	
2	Fluid Type	Select liquid or gas	
3	Flow Calc Fixed	Input Kfactor	Kfactor calculated by Table 3.3 Flow Equation and Kfactor Calculation
4	Ref SP	Input reference static pressure	This factor is used for gas. When fluid type is liquid, set 0 to Ref SP(Spb).
5	Ref Temp	Input reference temperature	
6	Temp K1	Input the density rate of change per temperature 1degC.	This factor is used for mass flow and normal standard volume flow of liquid. When fluid type is gas or volume flow of liquid, set 0 to TempK1. Refer to Table 3.4 Symbol

Equation for Basic flow calculation

The flow equation shown in Table 3.3 is applied to the transmitter by combination of fluid type and flow unit category.

Table 3.3 Flow Equation and Kfactor Calculation

Fluid Type	Flow unit category	Kfactor *2	Flow Equation
liquid	Mass Flow	$Kfactor = \pi/4 \times Nc \times C / \sqrt{1-\beta^4} \times \varepsilon \times d^2 \times \sqrt{2 \times \rho b}$	*1 $Qm, Qv \text{ or } Qv\_norm = \underline{\underline{Kfactor}} \times \sqrt{\Delta\rho \times (1+ \underline{\underline{Temp\ K1}} \times (T-\underline{\underline{Tb}}))}$
	Normal-Standard Volume Flow	$Kfactor = \pi/4 \times Nc \times C / \sqrt{1-\beta^4} \times \varepsilon \times d^2 \times \sqrt{2 \times \rho b / \rho\ norm}$	
	Volume Flow	$Kfactor = \pi/4 \times Nc \times C / \sqrt{1-\beta^4} \times \varepsilon \times d^2 \times \sqrt{2 / \rho b}$	
Gas	Mass Flow	$Kfactor = \pi/4 \times Nc \times C / \sqrt{1-\beta^4} \times \varepsilon \times d^2 \times \sqrt{2 \times \rho b \times 1/K}$	*1 $Qm \text{ or } Qv\_norm = \underline{\underline{Kfactor}} \times \sqrt{\Delta\rho \times \underline{\underline{Tb}}/T \times SP/\underline{\underline{SPb}}}$
	Normal-Standard Volume Flow	$Kfactor = \pi/4 \times Nc \times C / \sqrt{1-\beta^4} \times \varepsilon \times d^2 \times \sqrt{2 \times \rho b \times 1/K / \rho\ norm}$	
	Volume Flow	$Kfactor = \pi/4 \times Nc \times C / \sqrt{1-\beta^4} \times \varepsilon \times d^2 \times \sqrt{2 / (\rho b \times 1/K)}$	*1 $Qv = \underline{\underline{Kfactor}} \times \sqrt{\Delta\rho \times T/\underline{\underline{Tb}} \times \underline{\underline{SPb}}/SP}$

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*1 ═══ mark indicate user input.
*2 Kfactor must be calculated according to the specified flow unit.

Table 3.4 Symbol

No	Symbol	Description
1	Qm	Mass Flow
2	Qv	Volume Flow
3	Qv_norm	Normal-Standard Volume Flow
4	Nc	Unit convert factor
5	Kfactor	Basic flow Calcuration factor
6	C	Discharge Coefficient
7	ε	Expansion Factor
8	β	Diameter Ratio
9	d	Diameter of orifice
10	Δp	Differential Pressure (Transmitter setting unit)
11	ρb	Base Density on Tb, SPb condition
12	ρ norm	Density on Normal, Standard condition
13	Tb	Reference temperature (unit: K)
14	T	Temperature (unit: K)
15	SPb	Reference static pressure (unit: kPa abs)
16	SP	Static Pressure (unit: kPa abs)
17	Temp K1	The density rate of change per temperature 1degC of a density base value (value which set 100% to 1). For volume flow: set 0.
18	K	Compressibility factor

Note 1. The flow unit is not automatically converted. Refer to IM 01C25R01-01E for Nc calculation.
Note 2. Kfactor, SPb, and Tb are calculated using the equipment setting unit (differential pressure, static pressure, and temperature).
Note 3. Total flow is calculated using the transmitter setting unit.

Flow unit category

Table 3.5 Mass Flow Unit

Unit	LCD	Communication
grams per second	g/s	←
grams per minute	g/m	g/min
grams per hour	g/h	←
Kilograms per second	kg/s	←
kilograms per minute	kg/m	kg/min
kilograms per hour	kg/h	←
kilograms per day	kg/d	←
metric tons per minute	t/m	t/min
metric tons per hour	t/h	←
metric tons per day	t/d	←
pounds per second	lb/s	←
pounds per minute	lb/m	lb/min
pounds per hour	lb/h	←
pounds per day	lb/d	←
short tons per minute	STon/m	STon/min
short tons per hour	STon/h	←
short tons per day	STon/d	←
long tons per hour	LTon/h	←
long tons per day	LTon/d	←

Table 3.6 Normal/Standard Volume Flow Unit

Unit	LCD	Communication
normal cubic meter per hour	Nm3/h	←
normal liter per hour	NL/h	←
standard cubic feet per minute	SCFM	←
standard liter per hour	SL/h	←
standard liter per minute	SL/m	SL/min
standard liter per second	SL/s	←
normal cubic meter per day	Nm3/d	←
standard cubic feet per day	SCFD	←
standard cubic feet per hour	SCFH	←
standard cubic feet per second	SCFS	←
standard cubic meter per day	Sm3/d	←
standard cubic meter per hour	Sm3/h	←
thousand standard cubic feet per day	MSCFD	←
million standard cubic feet per day	MMSCFD	←

Table 3.7 Volume Flow Unit

Unit	LCD	Communication
cubic feet per minute	CFM	←
gallons per minute	GPM	←
liters per minute	L/m	L/min
imperial gallons per minute	IGal/m	Impgal/min
cubic meter per hour	m3/h	←
gallons per second	gal/s	←
million gallons per day	Mgal/d	←
liters per second	L/s	←
million liters per day	ML/d	←
cubic feet per second	CFS	←
cubic feet per day	ft3/d	←
cubic meters per second	m3/s	←
cubic meters per day	m3/d	←
imperial gallons per hour	IGal/h	Impgal/h
imperial gallons per day	IGal/d	Impgal/d
cubic feet per hour	CFH	←
cubic meters per minute	m3/m	m3/min
barrels per second	bbl/s	←
barrels per minute	bbl/m	bbl/min
barrels per hour	bbl/h	←
barrels per day	bbl/d	←
gallons per hour	gal/h	←
imperial gallons per second	IGal/s	Impgal/s
liters per hour	L/h	←
gallons per day	gal/d	←

3.3.15 Burst Mode

3.3.15.1 In the case of using HART 5

When the **Burst mode** is enabled, the transmitter continuously sends the stored data. The data is sent approximately three times per second as a digital signal when the transmitter is set in burst mode. When data is being sent in burst mode, other operations can be performed with the HART configuration tool.

(1) Selection of the transmission data.

Call up the **Burst option** parameter and select the data which is transferred.

- Procedure to call up the display

DD (HART 5)	**[Root Menu]** → Detailed setup → Output condition → HART output → Burst option →
DTM (HART 5)	Configuration → HART → Burst option →

Display Item	Contents
PV	Process variable assigned to PV (Either of differential pressure, static pressure, external temperature, and flow rate)
%range/current	Output in % and mA
Process vars/ crnt	Output in mA and process variables assigned to PV, SV, TV, and 4V. (Output in mA and four variables from differential pressure, static pressure, external temperature, flow rate, and total flow.)
Xmtr Variables	Selectable up to four variables from differential pressure, static pressure, external temperature, flow rate, and total flow. According to the procedure indicated in Burst Xmtr Vars, set the selected variables to four Slot. (For the Slot that is not used, set the same value as others.)

(2) Shift to the Burst mode.

To enable the Burst mode, select “On” at the **Burst mode** parameter.
To release the **Burst mode**, call up the **Burst mode** display and set it to “Off”.
This parameter is set to “Off” when the instrument is shipped.

- Procedure to call up the display

DD (HART 5)	**[Root Menu]** → Detailed setup → Output condition → HART output → Burst mode
DTM (HART 5)	Configuration → HART → Burst mode

Display Item	Contents
Off	Stop the burst mode
On	Start the burst mode

3.3.15.2 In the case of using HART 7

When the **Burst mode** is enabled, the transmitter continuously sends up to three data listed in Table 3.8.
Refer to the subsection 3.3.15.2.1 Burst Message for details.

When the **Burst mode** is set to “Wired HART Enabled”, transmitter continuously sends alarm signal also.
Refer to subsection 3.3.15.2.2 Event Notification for detail.

When changing the setting of **Burst mode**, set “Off” to the **Burst mode**.
Default setting is “Off”.

3.3.15.2.1 Burst Message and Burst Mode

(1) Burst message

EJX multivariable transmitter can transmit three burst messages at the maximum.
The parameters for **Burst Message** are as follows.

- Burst Command
- Update Period and Max Update Period
- Burst Msg Trigger Mode

Table 3.8 Burst parameters

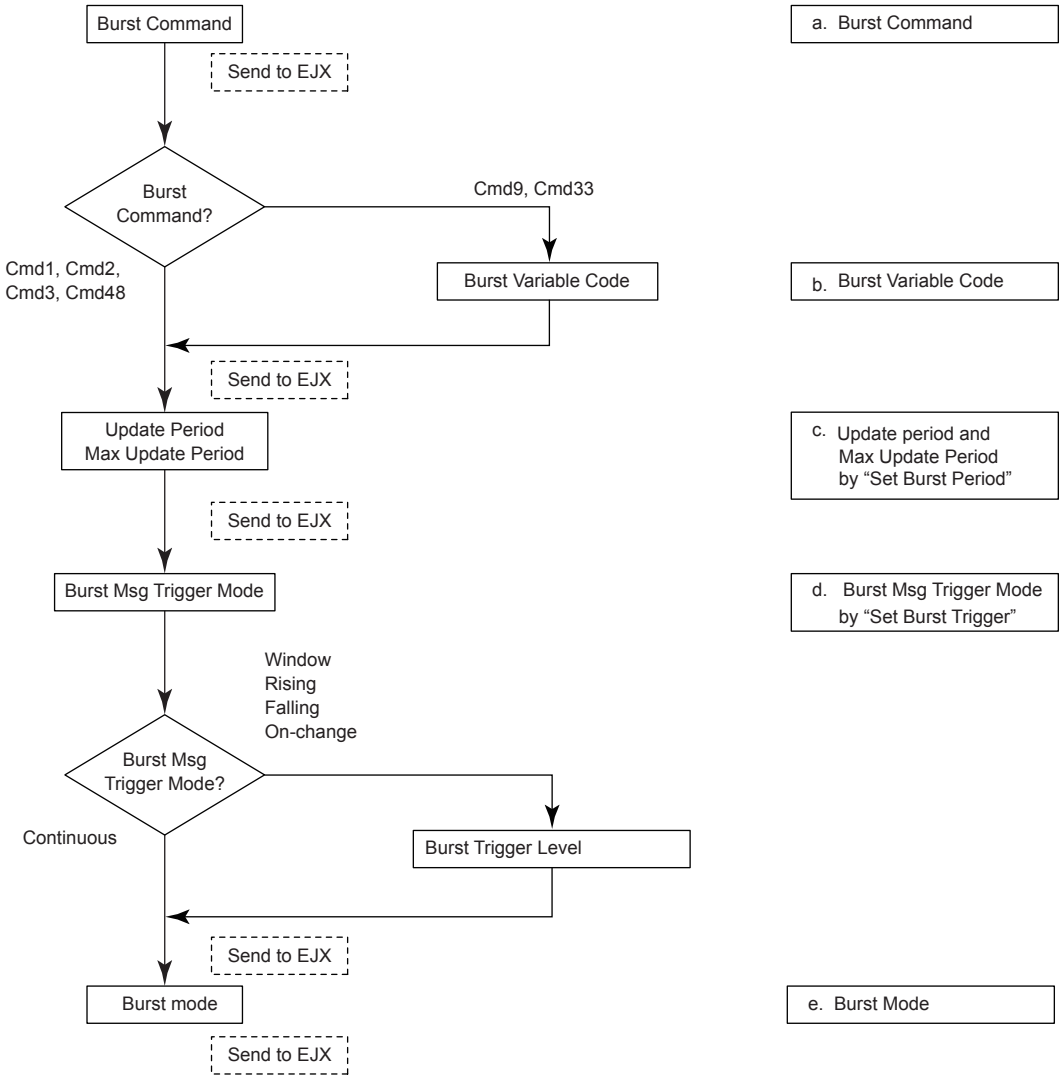
Command parameter	Burst Command	Burst Msg Trigger Mode	Burst Trigger Source	Burst Trigger Units
PV (Either of differential pressure, static pressure, external temperature, flow rate)	Cmd1:PV	Continuous	---	---
		Window	PV	Depend on the assigned variable to PV
		Rising		
		Falling		
		On-change		
% range/current (Percent of range, Loop current)	Cmd2:% range/current	Continuous	---	---
		Window	% range	%
		Rising		
		Falling		
		On-change		
Process vars/current (Loop current, PV, SV, TV, QV)	Cmd3:Dyn vars/current	Continuous	---	---
		Window	PV	Depend on the assigned variable to PV
		Rising		
		Falling		
		On-change		
Process vars/% range/ current with status*1 (Select up to eight variables from differential pressure, static pressure, external temperature, flow rate, total flow, percent of range, loop current, PV, SV, TV and QV)*2	Cmd9:Device vars w/Status	Continuous	---	---
		Window	Top of Burst Device Variables	Depends on mapping
		Rising		
		Falling		
		On-change		
Process vars/% range/ current (Select up to four variables from differential pressure, static pressure, external temperature, flow rate, total flow, percent of range, loop current, PV, SV, TV, and QV)*2	Cmd33:Device Variables	Continuous	Top of Burst Device Variables	Depend on the assigned variable to Burst Device Variables
		Window		
		Rising		
		Falling		
		On-change		
Self diagnosis information	Cmd48:Read Additional Device Status	Continuous	---	---
		On-change	All status	---

*1 : Output the data with time and status.
*2 : Select at **Burst Device Variables**

(2) Burst mode setting procedure

- Procedure to call up the display

DD (HART 7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Output condition →HART output → Burst Condition → Burst Message 1,2 or 3 → Burst Command



a. Burst Command

Select the transmission data at **Burst Command** parameter.

Burst Command	Command parameter
Cmd1: PV	Variable assigned to PV
Cmd2: % range/current	% range/current (Percent of range, Loop current)
Cmd3: Dyn vars/current	Process vars/current (Loop current, PV, SV, TV, QV)
Cmd9: Device vars w/Status	Process vars/% range/current Mapping by user
Cmd33: Device Variables	Process vars/% range/current Mapping by user
Cmd48: Read Additional Device Status	Self diagnosis information

b. Burst Variable Code

This parameter need to be set when **Burst Command** is Cmd9:Device vars w/Status (up to eight items) and Cmd33: Device Variables (up to four items).

- Procedure to call up the display

DD (HART 7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Output condition →HART output → Burst condition → Burst Message 1,2 or 3 → Burst Device Variables → Burst Variable Code →
Display Item	Contents
Flow	Select the flow rate
Pres	Select the differential pressure
SP	Select the static pressure
ET	Select the external temperature
Total Flow	Select the total flow
PV	Select the PV value
SV	Select the SV value
TV	Select the TV value
QV	Select the QV value
% rnge	Select the % output
Loop current	Select the output current
Not Used	–

c. Update period and Max Update Period

Set to **Update Period** and **Max Update Period**.
When the period that is earlier than the operation period of each process value was set, it is set automatically to become bigger than an operation period of EJX multivariable transmitter.
For **Update Period**, set the value that is smaller than **Max Update Period**.

- Procedure to call up the display

DD (HART 7) DTM (HART 7)	**[Root Menu]** → Detailed setup →Output condition →HART output → Burst condition → Burst Message 1,2 or 3 → Set Burst Period
→ Update Period / Max Update Period	0.5 s
	1 s
	2 s
	4 s
	8 s
	16 s
	32 s
	1 min
	5 min
	10 min
	15 min
	30 min
	45 min
	60 min

d. Burst Msg Trigger Mode

Set the **Burst Msg Trigger Mode** from the parameters shown below.
When **Burst Msg Trigger Mode** is Window, Rising or Falling, set the **Burst Trigger Level**.

- Procedure to call up the display

DD (HART 7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Output condition →HART output → Burst condition → Burst Message 1,2 or 3 → Set Burst Trigger →
Display Item	Contents
Continuous	Burst Message is transmitted continuously.
Window	In “Window” mode, the Trigger Value must be a positive number and is the symmetric window around the last communicated value.
Rising	In “Rising” mode, the Burst Message must be published when the source value exceeds the threshold established by the trigger value.
Falling	In “Falling” mode, the Burst Message must be published when the source value fall below the threshold established by the trigger value.
On-change	In “On-change” mode, the Burst Message must be published when the source value on change established by the trigger value.

e. Burst Mode

When the **Burst mode** is set to “Wired HART Enabled”, the transmitter starts to send the data.

- Procedure to call up the display

DD (HART 7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Output condition →HART output → Burst condition → Burst Message 1,2 or 3 → Burst mode → Wired HART Enabled

3.3.15.2.2 Event Notification

When a setting change and a change of the Self-diagnostics occur, device detect it as an event and can transmit an alarm signal continuously.
Up to four events that occurred can be stored.
When using this function, set to **Burst mode** as “Wired HART Enabled”.

(1) Set Event Notification

- Procedure to call up the display

DD (HART 7) DTM (HART 7)	**[Root Menu]** → Detailed setup →Output condition →HART output → Burst condition → Event Notification →
→ Event Mask	Set the status to detect
→ Event Notification Retry Time	Set the retry time when the event occur.
→ Max Update Time	Set the retry time when the event does not occur.
→ Event Debounce Interval	The setting of the minimum event duration
→ Event Notification Control	Stop the event monitor: Off Shift to the monitor state: Enable event notification on token-passing data link layer

a) Event Mask

Set the status to detect in the **Event Mask** parameter.

Device Status Mask
Status group 1 Mask to 11 Mask
Ext dev status Mask
Device Diagnostic Status 0 Mask
Device Diagnostic Status 1 Mask
AO saturated Mask
AO fixed Mask

b) Event Notification Retry Time/ Max Update Time/ Event Debounce Interval

Set to Event Notification Retry Time, Max Update Time and Event Debounce Interval.
For **Event Notification Retry Time**, set the value that is smaller than **Max Update Time**.

Event Notification Retry Time /Max Update Time	Event Debounce Interval
---	Off
0.5 s	0.5 s
1 s	1 s
2 s	2 s
4 s	4 s
8 s	8 s
16 s	16 s
32 s	32 s
1 min	1 min
5 min	5 min
10 min	10 min
15 min	15 min
30 min	30 min
45 min	45 min
60 min	60 min

c) Event Notification Control

Select “Enable event notification on token-passing data link layer” in the **Event Notification Control** parameter to shift to the monitor state:

(2) Acknowledge Event Notification

The transmission of the event message stops when event is approved.

- Procedure to call up the display

DD (HART 7) DTM (HART 7)	**[Root Menu]** → Detailed setup →Output condition → HART output → Burst condition → Event Notification → Knowledge →
→ Acknowledge Event Notification	Acquisition of the event number and approval.

a) Get Event Number

Confirm the latest event number.
Execute **Acknowledge Event Notification** method.

1) Enter Event Number is set to “0”.
2) OK.
3) Set “Trans 0: Read Event Notificaiton” to Select Transaction.
4) OK.
5) Confirm Event Number.

b) Acknowledge Event Notification

Execute **Acknowledge Event Notification** method.

1) Set to Enter Event Number is in confirmed Event Number a)5.
2) OK.
3) Set “Trans 1: Send Acknowledge” to Select Transaction.
4) OK.
5) Confirm Event Status is 0x00.

(3) Event Notification Record

- Procedure to call up the display

DD (HART 7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Output condition →HART output → Burst condition → Event Notification → Knowledge →
→ Acknowledge Event Notification	Acquisition of the event number and approval.

a) Get Event Number

Confirm the latest event number.
Execute **Acknowledge Event Notification** method.

1) Enter Event Number is set to “0”.
2) OK.
3) Set “Trans 0: Read Event Notificaiton” to Select Transaction.
4) OK.
5) Confirm Event Number.

b) Confirmation record of Event Notification

Confirm four events checked in a).
Execute **Acknowledge Event Notification** method.

1) Enter the event number to Enter Event Number which is confirmed in a)5.
2) OK.
3) Set “Trans 0: Read Event Notificaiton” to Select Transaction.
4) OK.
5) Knowledge menu displays events record.

Ex.) When the confirmed event number is 123.

Event Number	Explanation
123	The latest event
122	An event before the once.
121	An event before the twice.
120	An event before three times.

3.3.16 Multidrop Mode

3.3.16.1 In the case of using HART 5

“Multidropping” transmitters refer to the connection of several transmitters to a single communication transmission line. Up to 15 transmitters can be connected when set in the multidrop mode. To activate multidrop communication, the transmitter address must be changed to a number from 1 to 15. This change deactivates the 4 to 20 mA analog output, sending it to 4 mA. The alarm current is also disabled.

Setting of Multidrop Mode

(1) Polling address

- Procedure to call up the display

DD (HART 5)	**[Root Menu]** → Detailed setup → Output condition → HART output →
DTM (HART 5)	Configuration → HART →
→ Poll addr	Enter the number from 1 to 15

(2) Enabling the Multidrop Mode

About the procedure to call up the **Polling** display, please refer to the User’s Manual of each configuration tool.

NOTE

When the same polling address is set for two or more transmitters in multidrop mode, communication with these transmitters is disabled.

(3) Communication when set in multidrop mode.

- The HART configuration tool searches for a transmitter that is set in multidrop mode when it is turned on. When the HART configuration tool is connected to the transmitter, the polling address and the tag will be displayed.
- Select the desired transmitter. After that, normal communication to the selected transmitter is possible. However, the communication speed will be slow.

To release multidrop mode, call up the **Poll addr** display and set the address to “0”.

3.3.16.2 In the case of using HART 7

"Multidropping" transmitters refer to the connection of several transmitters to a single communication transmission line. Up to 63 transmitters can be connected when set in the multidrop mode. To activate multidrop communication, the transmitter address must be changed to a number from 1 to 63. This change deactivates the 4 to 20 mA analog output, sending it to 4 mA. The alarm current is also disabled.

Setting of Multidrop Mode

(1) Polling address

- Procedure to call up the display

DD (HART 7) DTM (HART 7)	**[Root Menu]** → Detailed setup →Output condition →HART output →
→ Poll addr	Enter the number from 1 to 63

(2) Enabling the Multidrop Mode

About the procedure to call up the **Polling** display, please refer to the User's Manual of each configuration tool.

When **Loop current mode** is set to "Enabled", an analog signal output is available for one device in a loop.

- Procedure to call up the display

DD (HART 7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Output condition →Analog output → Loop current mode →
Enabled	Loop current mode is enabled.
Disabled	Loop current mode is disabled.

NOTE

When the same polling address is set for two or more transmitters in multidrop mode, communication with these transmitters is disabled.

(3) Communication when set in multidrop mode.

- The HART configuration tool searches for a transmitter that is set in multidrop mode when it is turned on. When the HART configuration tool is connected to the transmitter, the polling address and the tag will be displayed.
- Select the desired transmitter. After that, normal communication to the selected transmitter is possible. However, the communication speed will be slow.

To release multidrop mode, call up the **Poll addr** display and set the address to "0".

3.3.17 Switching HART Protocol Revision

When the output signal code is "-J", HART protocol revision of EJX multivariable transmitter can be selectable from 5 or 7.
The HART protocol revision is set and shipped as specified in the order.
To change the HART protocol revision after shipment, follow the procedure shown below.

IMPORTANT

When changing the protocol revision, confirm the items below.

- Protocol revision supported by HART configuration tool must be the same or higher than new protocol revision of the EJX multivariable transmitter. (Refer to Table 2.1)
- Confirm that the DD or DTM which is suitable to new protocol revision of EJX multivariable transmitter is installed in the configuration tool. (Refer to Section 2.3 or 2.4)

1) Call up the parameter for protocol revision change

- Procedure to call up the **Chg universal rev** display.

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Device information → Field device info → Revision #'s → Chg universal rev
DTM (HART 5)	Configuration → HART → Chg universal rev

2) Activate the "Chg universal rev" method

IMPORTANT

The message is displayed to separate the transmitter from the automatic control loop. Confirm that the transmitter is separated.

3) Input the new revision number

An input column for new protocol revision number is displayed.
Input the new HART protocol revision number of "5" for HART 5 or "7" for HART 7.

4) Applying the new protocol revision
   a. Close the configuration tool
      After completion of Chg universal rev method, close the HART configuration tool.

NOTE

When using a FieldMate, close the main display of FieldMate.

   b. Restart the transmitter
      Turn off the power to the transmitter, and turn it on.

IMPORTANT

New protocol revision is applied only after having performed restart of the transmitter.

NOTE

A new HART revision number is displayed on the integral indicator for three (3) seconds after restart the transmitter. (Refer to section 2.1)

5) Confirming the new protocol revision
   a. Restart the HART configuration tool

NOTE

When execute the other parameter confirmation or setting change, execute after restart the configuration tool.

   b. Confirm the new HART protocol revision number

Call up the **Universal rev** parameter, and confirm that the new HART revision number is displayed.

- Procedure to call up the **Universal rev**. parameter.

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Device information → Field device info → Revision #'s → Universal rev →
DTM (HART 5)	Configuration → HART → Universal rev. →
5	HART protocol revision: 5
7	HART protocol revision: 7

4. Diagnostics

4.1 Self-Diagnostics

4.1.1 Identify Problems by Using the HART Configuration Tool

The HART configuration tool can be used to run self-diagnostics on a transmitter and check for incorrect data settings.

(1) Using DD(HART 5/HART 7) and DTM(HART 7)

The **Self test** and **Status** commands are available for self-diagnostics. When **Self test** is run, the integral indicator shows an error code and alarm message if the transmitter detects any illegal parameter settings or functional faults. See Table 4.5 Alarm Message Summary for probable cause and countermeasures.

- Procedure to call up the **Self test** display

[Root Menu] → Diag/Service → Test → Self test

If no error is detected, “Self test OK” is displayed on the configuration tool.
If the specific diagnostic item is known for the check, you can directly call up the item by using the **Status** command.
The status is categorized from 1 to 10 for HART 5, and from 1 to 11 for HART 7.
See Table 4.5 to determine the status group.
Show an example below to confirm the status of Status group 1.

- Procedure to call up the **Status** display

[Root Menu] → Diag/Service → Status → Status group 1

If no error is detected, “Off” is displayed on the configuration tool.
If there is an error, “On” is displayed on the configuration tool, and a countermeasure for that error is necessary.

Example of display:	Illegal P LRV	On
	Illegal P URV	Off
	Illegal P SPAN	Off
	P SPAN trim err	Off
	P ZERO trim err	Off

The HART configuration tool diagnoses at each communication.
When an improper operation is performed, the error message is displayed.
See Table 4.6 HART Configuration Tool Error Message.

(2) Using DTM(HART 5)

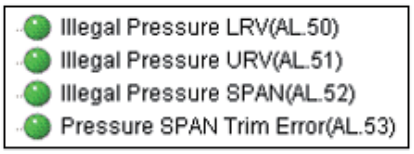
The **Device Status** commands are used for self-diagnostics. When **Device Status** is run, the integral indicator shows an error code and alarm message if the transmitter detects any illegal parameter settings or functional faults. See Table 4.5 Alarm Message Summary for probable cause and countermeasures.

- Procedure to call up the **Device Status** display

Device Status

If no error is detected, “Status: Normal” is displayed on the configuration tool.
If the specific diagnostic item is known for the check, you can directly call up the item by using the Diagnostic List in the Device Status display.
The Diagnostic List is categorized to Device Status, Hardware Failure, Transducer Status, Diag Status, and Configuration.

See Table 4.5 Alarm Message Summary.
If no error is detected, color symbol which shows Normal State is displayed on top of the error message.
If color symbol which shows Error State is displayed, there is an error and a countermeasure for that error is necessary.



The HART configuration tool diagnoses at each communication.
When an improper operation is performed, the error message is displayed.
See Table 4.6 HART Configuration Tool Error Message.

4.1.2 Checking with Integral Indicator

NOTE

If an error is detected by running self-diagnostics, an error number is displayed on the integral indicator. If there is more than one error, the error number changes at three-second intervals.
See table 4.3.1 regarding the alarm codes.

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Figure 4.1 Integral Indicator

4.1.3 Status information available for HART 7

Status added to HART 7 is explained below.

(1) Device Status
Device Status indicates the current operating status of the device. (Refer to Table 4.7)
Table 4.10 indicates the relationship between alarm and Device Status.

- Procedure to call up the display using DD (HART 7) and DTM (HART 7)

DD (HART 7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Status → Device Status

(2) Extended Device Status
Ext dev status contains commonly used device information. (Refer to Table 4.8)
Table 4.10 indicates the relationship between alarm and Extended Device Status.

- Procedure to call up the display using DD (HART 7) and DTM (HART 7)

DD (HART 7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Status → Ext dev status

(3) Data quality and Limit status
EJX multivariable transmitter can handle Dynamic Variables (PV, SV, TV, QV) and Device Variables (DP(Pres), SP, ET, Flow, Total Flow, % range, Loop current). Each variable contains data quality and limit status for providing useful status about the data value. The data quality is normally “Good”. However, in the case of a sensor failure or out of measurement range, it turns to “Bad” or “Poor Accuracy”. The limit status indicates whether the data value is limited (i.e., not responding to the process). When the limit status is “Constant”, the value will not be changed. For detail, refer to Table 4.9 and 4.10.

- Procedure to call up the display using DD (HART 7) and DTM (HART 7)

[Dynamic Variables]

DD (HART 7) DTM (HART 7)	**[Root Menu]** → Process variables → Output vars → PV →
→ PV Data Quality	Good, Poor Accuracy, Manual/ Fixed, or Bad is displayed.
→ PV Limit Status	Constant, Low Limit, High Limit, or Not Limited is displayed.
It is the same about the SV, TV, and QV.	

[Device Variables]

DD (HART 7) DTM (HART 7)	**[Root Menu]** → Process variables → Device variables and Status →
→ Flow Data Quality	Good, Poor Accuracy, Manual/ Fixed, or Bad is displayed.
→ Flow Limit Status	Constant, Low Limit, High Limit, or Not Limited is displayed.
It is the same about the Pres, SP, ET, Total Flow, % Range, and Loop Current. .	

(4) Time Stamp
Time Stamp displays the date and the time information which EJX multivariable transmitter maintains from the time of the power on.
It is used as the additional information of the process value and the event.

- Procedure to call up the display using DD (HART 7) and DTM (HART 7)

DD (HART 7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Status → Time Stamp
→ Current Date	It shows the number of operating days.
→ Current Time	It shows the running time.

NOTE

Time Stamp is reset when powering on.

(5) Configuration Change Counter
The Configuration Change Counter is incremented once for every user action that changes the device's configuration or calibration. This value is never reset or written and maintained even if power is removed from the device.

- Procedure to call up the display using DD (HART 7) and DTM (HART 7)

DD (HART 7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Status →
→ Cfg chng count	The configuration change times are counted. The counted value cannot be reset.

(6) Reset Configuration Changed Flag
Configuration Changed Flag can be reset by this method.

NOTE

Refer to Configuration Changed (0x40) in the Table 4.7.

- Procedure to call up the display using DD (HART 7) and DTM (HART 7)

DD (HART 7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Status → Reset Cfg Chng flag

4.2 Advanced Diagnostics

4.2.1 Multi-sensing Process Monitoring

Multi-sensing process monitoring function (option code: /DG6) provides the advanced diagnostics to detect the abnormal conditions in process environment such as an impulse line etc. by using the EJX multisensing technology and its unique algorithm. There are following two functions.

■ Impulse Line Blockage Detection (ILBD)

The fluctuation change of differential pressure and static pressure is monitored by a silicone resonant sensor and detects a potential blockage condition. The differential pressure transmitter gives also a result of which pressure-side was plugged.

■ Heat Trace Monitoring

The two temperature sensors built in the EJX multivariable transmitter calculate the flange temperature, the change of which enables to detect the heat trace breakage or the abnormal temperature due to the failure.

4.2.2 Impulse Line Blockage Detection (ILBD)

ILBD is carried out by using statistical analysis based on the measured values of process fluctuations that exist in a fluid. An alarm on the EJX multivariable transmitter LCD display or an analog alert is generated if blockage reaches a certain level. EJX multivariable transmitter provides the following results as blockage detection.

(1) A Blocking and B Blocking
These are blockage detections based on the fluctuation value change of differential pressure/pressure. With a differential pressure transmitter, each result indicates that both or single side is plugged.

(2) L Side Blocking
It is a low-pressure side blockage detection based on the change of **BlkF** or low-pressure-side fluctuation value.

(3) H Side Blocking
It is a high-pressure side blockage detection based on the change of **BlkF** or high-pressure-side fluctuation value.

*: **BlkF** indicates blockage degree characterized by a comparison of the high- and low-pressure-side fluctuation values. For the details, refer to Figure 4.2.2.

IMPORTANT

- The pressure fluctuation amplitude in fluids must be sufficiently large for blockages to be detected.
- If the pressure fluctuation amplitude is too low for a reference value to be obtained, blockages detection operation cannot be performed with an alarm that the reference value is invalid.
- The pressure fluctuation amplitude may decrease due to other causes unrelated with a blockage according to process condition. In above case, a false alarm of an impulse line blockage may be generated. Before taking action in response to a blockage alarm, consider the plant operating conditions.

■ Notes for Pressure or Level Measurement

With pressure or level measurement, the pressure fluctuation amplitude may reduce especially for the following cases.

● Pressure Measurement

- Operational pressure is near outside of diagnostic range.
- Even though pressure is constant, the flow decreases than that under normal condition.
- A source of pressure fluctuation (pump, compressor, blower, etc.) is shut down. As a result, the pressure fluctuation amplitude decreases.

● Level Measurement

- A transmitter is used to measure tank level and the flow of fluid into or out of the tank comes to a stop.
- The agitator in the tank is shut down.
- A source of pressure variation (a compressor, etc.) that controls the internal pressure of a sealed (closed) tank is shut down.

Before taking action in response to a blockage alarm, consider the plant operating conditions.

■ Functional block diagram

The figure below shows the functional block diagram of ILBD.

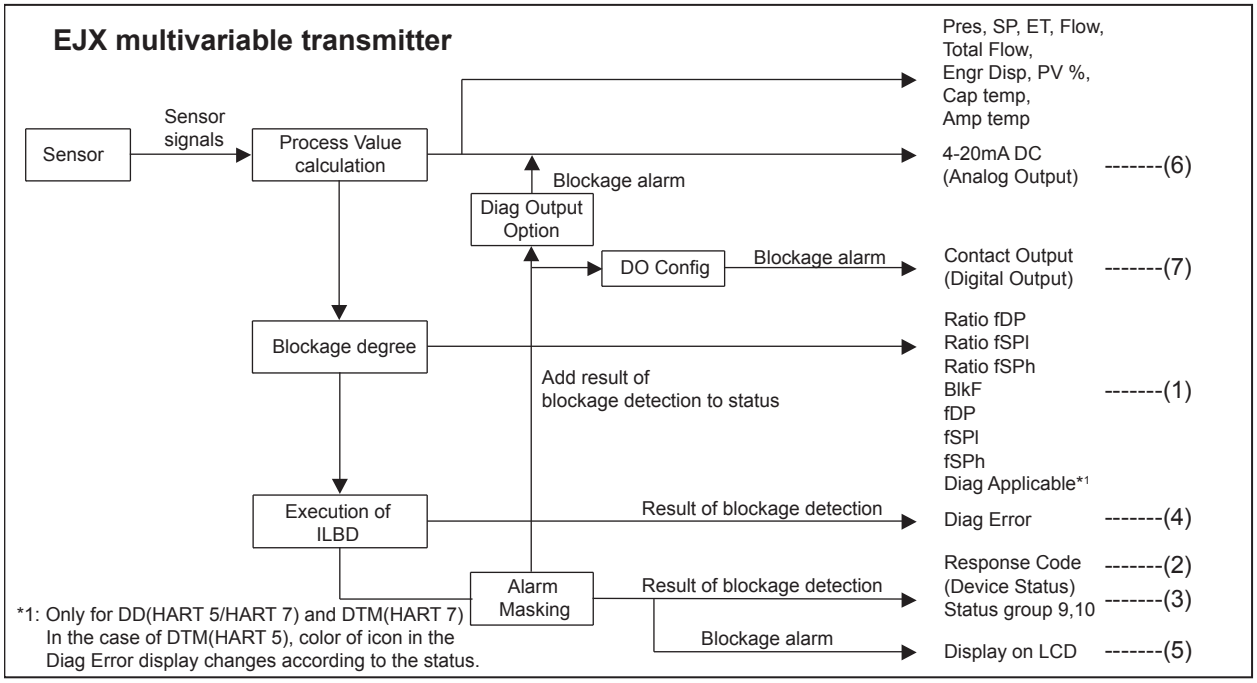

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Figure 4.2 Functional Block Diagram of ILBD

The following outputs are given for the ILBD results.

Table 4.1 List of Outputs for ILBD

#	OUTPUT Parameter name	Remarks
(1)	Ratio fDP	Parameters based on the fluctuation value and blockage degree. **[Diag DPComp:** Non-Compensation] $\textbf{Ratio fDP} = \sqrt{\frac{\textbf{fDP}}{\textbf{Ref fDP}}}$ **[Diag DPComp:** Compensation] $\textbf{Ratio fDP} = \sqrt{\frac{\textbf{fDP}}{\textbf{Ref fDP}}} \times \left\lvert \frac{\textbf{Ref DPAvg}}{\textbf{DPAvg}} \right\rvert$
	Ratio fSPl	$\textbf{Ratio fSPl} = \sqrt{\frac{\textbf{fSPl}}{\textbf{Ref fSPl}}}$
	Ratio fSPh	$\textbf{Ratio fSPh} = \sqrt{\frac{\textbf{fSPh}}{\textbf{Ref fSPh}}}$
	BlkF	Blockage degree characterized in comparison of high-pressure side and low-pressure side pressure fluctuation value.
	fDP	Average value of the sum of squares of differential pressure fluctuations.
	fSPl	Average value of the sum of squares of low-pressure side static pressure fluctuation.
	fSPh	Average value of the sum of squares of high-pressure side static pressure fluctuation.
	Diag Applicable*1	After the reference value is obtained, the applicable blockage defection and the status of abnormal fluctuation are displayed on this parameter.
(2)	Response Code Device Status	When an impulse line blockage is detected, “More Status Avairable” is generated in Response Code Device Status.
(3)	Status group 9,10	When an impulse line blockage is detected, the result of the blockage detection (alarm status) is indicated.
(4)	Diag Error	When an impulse line blockage is detected, the results of the blockage detection (alarm status) is indicated.
(5)	Display on LCD	When impulse line blockage is detected, an alarm status is displayed on LCD.
(6)	Analog Output	When impulse line blockage is detected, an alarm status is output on 4 to 20mA.
(7)	Digital Output	When impulse line blockage is detected, an alarm status is output on Status output.

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4.2.2.1 Blockage Detection

■ Limit parameter

When the parameter based on pressure fluctuation exceeds the preset value, EJX diagnoses an impulse line as blockage and gives an alarm. The threshold values are set to Limit parameter shown in below table.

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Diag Parameters → ILBD Parameters → Configuration → Diag Lim →
DTM (HART 5)	Diag and Service → Advanced Diag Configurations → Impulse Line Blockage Detection → Threshold → Sensitivity →

Table 4.2 Limit Parameter

#	Parameter	Threshold value
[1]	Lim fDPmax	Threshold to detect “A Blocking” by using **Ratio fDP**
[2]	Lim fDPmin	Threshold to detect “B Blocking” by using **Ratio fDP**
[3]	Lim fSPlmax	Threshold to detect “Large Fluct L” by using **Ratio fSPl**
[4]	Lim fSPlmin	Threshold to detect “L Side Blocking” by using **Ratio fSPl**
[5]	Lim fSPhmax	Threshold to detect “Large Fluct H” by using **Ratio fSPh**
[6]	Lim fSPhmin	Threshold to detect “H Side Blocking” by using **Ratio fSPh**
[7]	Lim BlkFmax	Threshold to detect “H Side Blocking” by using **BlkF**
[8]	Lim BlkFmin	Threshold to detect “L Side Blocking” by using **BlkF**
[9]	Lim DPAvgmax	Threshold to detect “ILDB over range” by using **DPAvg** and to detect “Invalid Ref xx” by using **Ref DPAvg**
[10]	Lim DPAvgmin	Threshold to detect “ILDB over range” by using **DPAvg** and to detect “Invalid Ref xx” by using **Ref DPAvg**

Table 4.3 shows the default values at the factory setting.

NOTE

- When ILBD is performed for the first time, use the default value. If the pressure fluctuation amplitude is low or a false alarm is often generated after ILBD is performed, change the values of Limit parameters according to the procedure described in subsection 4.2.2.10. Tuning

Table 4.3 Default Values of Limit Parameter

#	Parameter	Multivariable Transmitter
		EJX910A, EJX930A
[1]	Lim fDPmax	3
[2]	Lim fDPmin	0.3
[3]	Lim fSPlmax	5
[4]	Lim fSPlmin	0.5
[5]	Lim fSPhmax	5
[6]	Lim fSPhmin	0.5
[7]	Lim BlkFmax	0.6
[8]	Lim BlkFmin	-0.6
[9]	Lim DPAvgmax Note 1	1
[10]	Lim DPAvgmin Note 1	0.05

Note 1: It indicates the threshold value for “ILBD over range” (refer to subsection 4.2.2.5).

■ A/B Blocking Detection

“A Blocking” and “B Blocking” indicates the result estimated from blockage degree based on the difference of the high- and low-pressure-side fluctuation values. **Ratio fDP**, SQRT (**fDP / Ref fDP**) is used to detect A/B blocking. **Ref fDP** is the average value of the sum of squares of differential pressure fluctuations under normal condition.

As the value of **Ratio fDP** exceeds the value of **Lim fDPmax**, EJX gives basically an alarm of “A Blocking”. On the other hand, if this value is below the value of **Lim fDPmin**, EJX gives an alarm of “B Blocking.

As a high- or low-pressure-side blockage progresses, **fDP** increases. Therefore, “A Blocking” with a differential pressure transmitter indicates that a single-side impulse line is plugged for a differential pressure transmitter. As the both-side blockages progress simultaneously, **fDP** decreases. Therefore, “B Blocking” with a differential pressure transmitter indicates that both-side impulse lines are plugged.

NOTE

A single-side impulse line blockage may generate “B blocking” under the condition where the fluctuation amplitude is much different between high- and low-pressure sides.

■ H/L Blocking Detection

EJX differential pressure transmitter enables to detect both-, a high-, or low-pressure-side blockage. The blockage degree characterized by a comparison of high-pressure side and low-pressure-side fluctuation values, **BlkF**, is used to detect it. The value changes within a range of –1 to +1. As **BlkF** approaches +1, the high-pressure-side blockage progresses. On the other hand, if it approaches –1, the low-pressure-side blockage progresses.

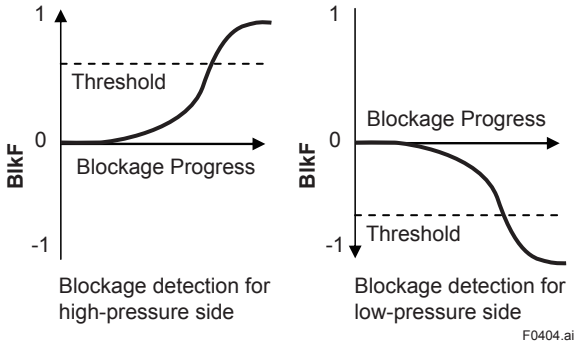

Figure 4.3 Relation between Blockage Progress and BlkF

The each threshold value to detect the high- or low-pressure-side blockage is set to **Lim BlkFmax** or **Lim BlkFmin**.

■ L Side Blocking Detection

BlkF is preferentially used to "L Side Blocking" detection. If **BlkF** cannot be used, **Ratio fSPl**, SQRT (**fSPl / Ref fSPl**) is used to "L Side Blocking" detection. **Ref fSPl** is the average value of the sum of squares of low-pressure-side static pressure fluctuations under normal condition.

As the value of **Ratio fSPl** is below the value of **Lim fSPlmin**, EJX gives an alarm of "L Side Blocking".

On the other hand, if this value exceeds the value of **Lim fSPlmax**, EJX gives an alarm of “Large Fluct L”.

■ H Side Blocking Detection

BlkF is preferentially used to "H Side Blocking" detection. If **BlkF** cannot be used, **Ratio fSPh**, SQRT (**fSPh / Ref fSPh**) is used to "H Side Blocking" detection. **Ref fSPh** is the average value of the sum of squares of high-pressure-side static pressure fluctuations under normal condition.

As the value of **Ratio fSPh** is below the value of **Lim fSPhmin**, EJX gives an alarm of "H Side Blocking".

On the other hand, if this value exceeds the value of **Lim fSPhmax**, EJX gives an alarm of “Large Fluct H”.

■ Large Fluctuation Detection

When a pump or compressor starts, the large fluctuation is generated as process condition changes rapidly. This phenomenon affects process fluctuation measurement; so correct blockage detection is not performed.

If “Large Fluct L” or “Large Fluct H” is detected, consider whether a blockage result is correct.

The threshold values to detect large fluctuation are set to **Lim fSPlmax** and **Lim fSPhmax**.

Since these values are enough to detect large fluctuation, it is not almost necessary to change them.

4.2.2.2 Combination of Reference Result and Blockage Detection

■ Diag Applicable

An EJX multivariable transmitter can detect four modes of impulse line blockage: both-sides, high-pressure side, low-pressure side, and/or single-side and abnormal fluctuation when all the reference values are properly measured. However, the detectable alarm mode combination is limited when some of the reference values are invalid. Available Blockage Detection are shown in the below figure.

NOTE

- **Ref fDP** must be larger than the specified level shown in Table 4.4 (refer to subsection 4.2.2.6). No blockage can be detected when **Ref fDP** is not large enough.
- The plausibility of blockage detection needs to be confirmed by blockage simulation test. The simulation test can be performed by the appropriate manifold operation (refer to subsection 4.2.2.8).

[Differential pressure measurement]

Fluctuation Parameters		Simulation Test	Available Blockage Detection
Ref fDP:	OK	• Test for low-pressure side • Test for high-pressure side • Test for both-pressure sides	• B Blocking detection (by using **Ratio fDP**) • L Side Blocking detection (by using **Ratio fSPl**) • H Side Blocking detection (by using **Ratio fSPh**) • H/L Side Blocking detection (by using **BlkF**)
Ref fSPl:	OK		
Ref fSPh:	OK		
Ref BlkF:	OK		
Ref fDP:	OK	• Test for low-pressure side • Test for high-pressure side • Test for both-pressure sides	•A/B Blocking detection (by using **Ratio fDP**) •L Side Blocking detection (by using **Ratio fSPl**) •H Side Blocking detection (by using **Ratio fSPh**)
Ref fSPl:	OK		
Ref fSPh:	OK		
Ref BlkF:	NG		
Ref fDP:	OK	• Test for high-pressure side	•A Blocking detection (by using **Ratio fDP**) •H Side Blocking detection (by using **Ratio fSPh**)
Ref fSPl:	NG		
Ref fSPh:	OK		
Ref BlkF:	NG		
Ref fDP:	OK	• Test for both-pressure sides	•B Blocking detection (by using **Ratio fDP**)
Ref fSPl:	NG		
Ref fSPh:	NG		
Ref BlkF:	NG		

[Gauge/absolute pressure and level measurement]

Fluctuation Parameters		Simulation Test	Available Blockage Detection
Ref fDP:	OK	• Test for high-pressure side	• B Blocking detection (by using **Ratio fDP**)

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4.2.2.3 Operation Parameters

■ Diag Mode

Diag Mode gives the directive for the ILBD operation. There are following three modes.

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Diag Parameters → ILBD Parameters → Configuration → Set Diag Mode →
DTM (HART 5)	Diag and Service → Advanced Diag Configurations → Impulse Line Blockage Detection → Diag Mode →

Diag Mode

Mode	Function
Stop	The blockage detection operation is stopped.
Calculation	The blockage detection operation is performed. Alarms are generated along with the result.
Reference	Reference values for the blockage detection are obtained and updated to the latest. After sampling reference values, this mode changes to "Calculation".

When the blockage detection operation is performed, set “Calculation” to **Diag Mode**. “Stop” must be set when you change a threshold value or set an alarm. “Reference” is set in order to obtain the reference fluctuation values under the normal configuration.

NOTE

When setting ILBD parameters in the transmitter via “Online Parameter” of the DTM (HART 5) menu, Diag Mode automatically changes to 0 (Stop). After the setting, Diag Mode automatically returns to the original value.

NOTE

When setting ILBD parameters in the transmitter via “Download to device” of the DTM (HART 5) menu, Diag Mode automatically changes to 0 (Stop).

■ Diag Period

The values such as **Ratio fDP** and **BlkF** are averaged based on several hundreds of pressure fluctuation values in constant time. **Diag Period** defines the sampling time is. The default value at the shipment is set to 180 sec.

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Diag Parameters → ILBD Parameters → Configuration → Diag Period →
DTM (HART 5)	Diag and Service → Advanced Diag Configurations → Impulse Line Blockage Detection → Diag Period →

For the information on how to change the sampling period, refer to subsection 4.2.2.10.

■ Diag Supp Count

When the value as **Ratio fDP** or **BlkF** exceeds the threshold value for several times in a row, it is estimated that the impulse line is plugged. **Diag Supp Count** defines the number of times to estimate blockage detection.

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Diag Parameters → ILBD Parameters → Configuration → Diag Supp Count →
DTM (HART 5)	Diag and Service → Advanced Diag Configurations → Impulse Line Blockage Detection → Threshold → Diag Suppress Count →

If **Diag Supp Count** is set to three times, an alarm is not generated at part ‘A’ in Figure 4.4. Because the first and second values only exceeded consecutively the threshold.

When the value exceeds consecutively the threshold value three times, an alarm is generated (see part ‘B’ in Figure 4.4).

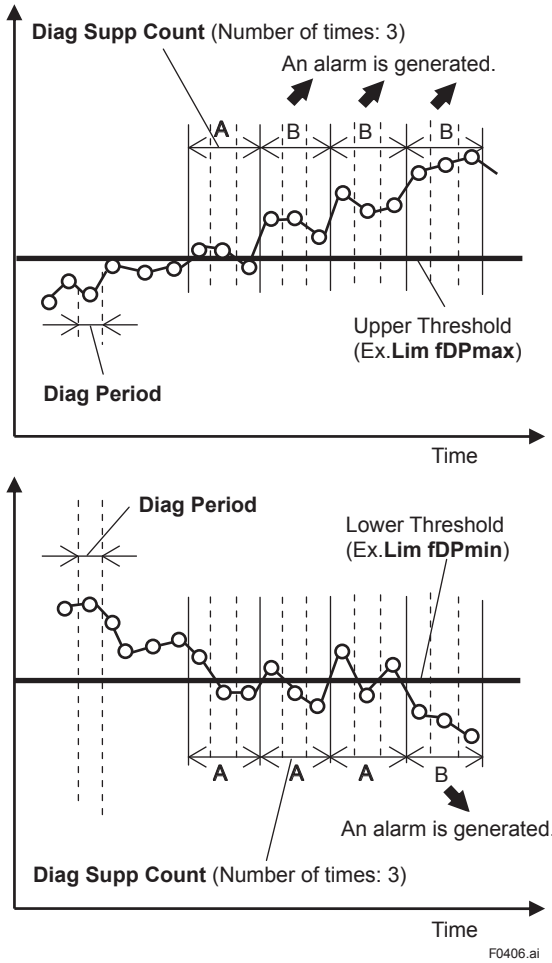

Figure 4.4 Relationship of Diag Supp Count and Alarm

The number of detection to give an alarm is set for each blockage detection function. The default value at the shipment is set to three times.

If fluctuating around the threshold value, an alarm may be often generated. In this case, change the threshold value (Limit parameter) or the sampling time (**Diag Period**) to enhance the accuracy of the blockage detection. Refer to subsection 4.2.2.10.

4.2.2.4 Operating Procedure

The basic flow of the ILBD operation is as follows.

1) Initial setting
2) Condition check
3) Start up
4) Perform the ILBD algorithm.

If an alarm is often generated or the process condition changed in the ILBD operation, do tuning to change the alarm setting, or to reset the reference values.

Fill out the information to the checklist, at the process shown in below figure.
(Refer to the Appendix 1. ILBD Check List)

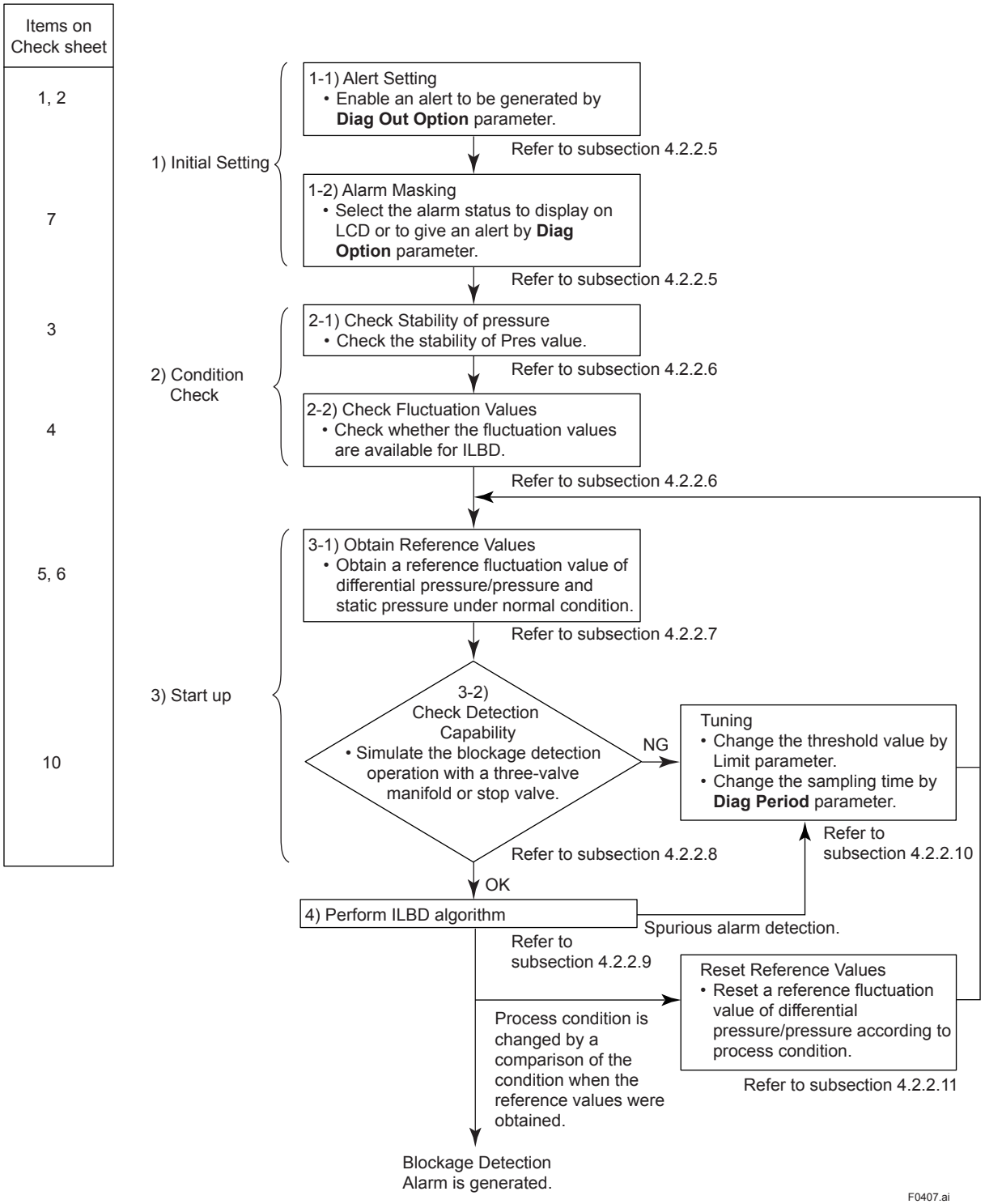
Items on Check sheet
1, 2
7
3
4
5, 6
10
1) Initial Setting
2) Condition Check
3) Start up
1-1) Alert Setting
• Enable an alert to be generated by Diag Out Option parameter.
Refer to subsection 4.2.2.5
1-2) Alarm Masking
• Select the alarm status to display on LCD or to give an alert by Diag Option parameter.
Refer to subsection 4.2.2.5
2-1) Check Stability of pressure
• Check the stability of Pres value.
Refer to subsection 4.2.2.6
2-2) Check Fluctuation Values
• Check whether the fluctuation values are available for ILBD.
Refer to subsection 4.2.2.6
3-1) Obtain Reference Values
• Obtain a reference fluctuation value of differential pressure/pressure and static pressure under normal condition.
Refer to subsection 4.2.2.7
3-2) Check Detection Capability
• Simulate the blockage detection operation with a three-valve manifold or stop valve.
NG
Tuning
• Change the threshold value by Limit parameter.
• Change the sampling time by Diag Period parameter.
Refer to subsection 4.2.2.10
Refer to subsection 4.2.2.8
OK
4) Perform ILBD algorithm
Spurious alarm detection.
Refer to subsection 4.2.2.9
Reset Reference Values
• Reset a reference fluctuation value of differential pressure/pressure according to process condition.
Refer to subsection 4.2.2.11
Process condition is changed by a comparison of the condition when the reference values were obtained.
Blockage Detection Alarm is generated.
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Figure 4.5 Flow Chart of ILBD Operation

4.2.2.5 Alarm and Alert Setting

The abnormal results as the blockage detection and high/low flange temperature (heat trace monitoring) are given through an analog alert or the LCD display of alarm status. Before performing the ILBD operation, it is necessary to set the alarm and alert according to the following procedure.

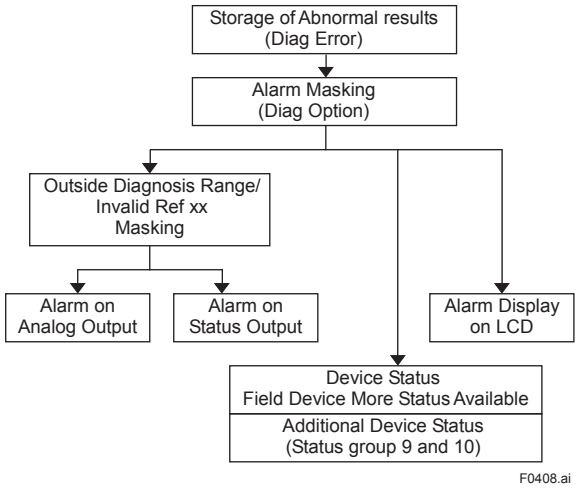


Figure 4.6 Alarm and Alert Setting

■ Alarm Status

When the algorithm of ILBD and Heat trace monitoring detect the abnormality, the result is stored in **Diag Error**. The alarm status based on the detected abnormality is displayed to **Diag Error**.

(Displayed to **Impulse Line Blockage Detection** and **Heat Trace** for DTM(HART 5))

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Diag Parameters → Diag Error →
DTM (HART 5)	Diag and Service → Advanced Diag Alerts → Diag Error

Bit	DD (HART 5/HART 7) DTM (HART 7)	DTM (HART 5)	Category
0	Not used	Not used	
1	Not used	Not used	
2	A Blocking	A Blocking	ILBD
3	Large Fluct L	Large Fluctuation of Low Side	
4	Large Fluct H	Large Fluctuation of High Side	
5	L Side Blocking	Low Side Blocking	
6	H Side Blocking	High Side Blocking	
7	B Blocking	B Blocking	
8	Invalid Ref F	Invalid Ref BlkF	
9	Invalid Ref SPH	Invalid Ref fSPh	
10	Invalid Ref SPL	Invalid Ref fSPl	
11	Invalid Ref DP	Invalid Ref fDP	
12	ILBD over range	Outside Diagnosis Range	
13	FT low alarm	Flg Temp Low Alarm	Heat trace monitoring
14	FT high alarm	Flg Temp High Alarm	
15	Not used	Not used	

Note: FT indicates the flange temperature.

● ILBD over range (Outside Diagnosis Range)

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Diag Parameters → ILBD Parameters → Configuration → Diag Lim →
DTM (HART 5)	Diag and Service → Advanced Diag Configurations → Impulse Line Blockage Detection → Threshold →

1) Lim DPAvgmax
Lim DPAvgmax is the upper limit of the diagnostic capability range. The limit value can be changed when **Diag Mode** is “Stop”.

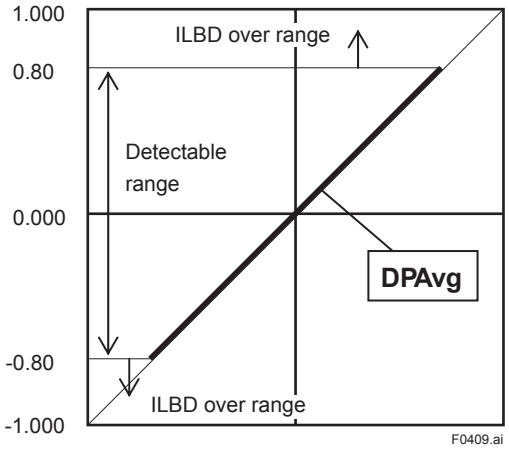
DPAvg indicates the ratio of the average of differential pressure to the EJX maximum span regarded as 1. When **DPAvg** exceeds this limit, “ILBD over range” is generated so that the blockage detection becomes impossible.

2) Lim DPAvgmin
Lim DPAvgmin is the lower limit of the diagnostic capability range. The limit value can be changed when **Diag Mode** is “Stop”.

When **DPAvg** is below this limit, “ILBD over range” is generated so that the blockage detection becomes impossible.

<Example>
When the level range that can be measured by the transmitter with 100 kPa span is –80 to 80 kPa, the limits are set as follows.

- **Lim DPAvgmax**: 0.80
- **Lim DPAvgmax**: –0.80



● Invalid Ref F, SPH, SPL, or DP

This alarm indicates that the reference value under normal condition is invalid. If **Ref F** is invalid, the blockage detection excluding **BlkF** is carried out. If blockage detection function based on **BlkF** is required, obtain the reference value again.

Also when **Ref DPAvg** is below **Lim DPAvgmin** or exceeds **Lim DPAvgmax**, all reference value becomes invalid so that “Invalid Ref DP”, “Invalid Ref SPL”, “Invalid Ref SPH”, and “Invalid Ref F” are generated.

■ Alarm Masking

● Diag Option

The alarms linked to an analog alert and LCD display are selected by **Diag Option**.

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Diag Parameters → Diag Option →
DTM (HART 5)	Diag and Service → Advanced Diag Configurations → Impulse Line Blockage Detection → Diag Option →

The bit of **Diag Option** is corresponding to that of **Diag Error**. The following alarms are set at the factory setting, which is corresponding to hexadecimal 0x08FC.

DD (HART 5/HART 7) DTM (HART 7)	DTM (HART 5)
A Blocking	A Blocking
Large Fluct L	Large Fluctuation of Low Side
Large Fluct H	Large Fluctuation of High Side
L Side Blocking	Low Side Blocking
H Side Blocking	High Side Blocking
B Blocking	B Blocking
Invalid Ref DP	Invalid Ref fDP

To Link the alarm to an analog alert and LCD display, follow the procedure below.

1) Set “Stop” to **Diag Mode**.
2) Check each checkbox of the alarm, which is selectable from bit 2 to 14.

Note: Set to “Calculation” after setting the parameter.

■ Alert Setting

● Diag Out Option

When an alert regarding the impulse line blockage or high/low flange temperature is generated, the output value of 4-20 mA analog signal can be changed.

Mode	Function
Off	Keeping PV measurement. The alert is not reflected to 4-20 mA analog signal.
Burnout	The analog signal is shifted to the value of **AO upper limit** or **AO lower limit** when an alert is generated. The shifted direction follows Burnout switch setting.
Fall back	The analog signal is hold to the specific value, **Diag Fixed Out Val**, when an alert is generated.

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Diag Parameters → Diag Output → Diag Out Option →
DTM (HART 5)	Diag and Service → Advanced Diag Configurations → Diag Output → Diag Out Option →

■ Diag Fixed Out Val

This parameter is used when “Fall back” is selected to **Diag Output Option**.

When an alert is generated, the 4-20 mA analog signal is held on the value specified by this parameter.

The value can be entered within 3.8 to 21.6 mA.

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Diag Parameters → Diag Output → Diag Fixed Out Val →
DTM (HART 5)	Diag and Service → Advanced Diag Configurations → Diag Output → Diag Out Option →

● Status Output for Advanced diagnostic

The output of the abnormal results are applicable for a transistor output (open collector) of an on/off signal according to the status of high and low alarm limits, which are values set to Limit parameters as shown in subsection 4.2.2.1. About the **Flg temp Hi Alert Val**, or **Flg temp Lo Alert Val** for Heat trace monitoring, refer to subsection 4.2.3.2.

■ DO Select

If the advanced diagnostic function is installed, the following modes can be also assigned to the status output in addition to Pres, SP, Temp and Flow.

Mode	Function
Diag Alarm	The status regarding advanced diagnostic masked by **Diag Option** is output.
All	All status of Press, SP, Temp, Flow and advanced diagnostic are output.

■ Alarm Display on LCD

If the ILBD algorithm detects the abnormality, the content of the detected result is displayed with “AL.88” or “AL.89” on the LCD. “AL.88” indicates that condition is not applicable for the abnormality detection and “AL.89” indicates the abnormality is detected.

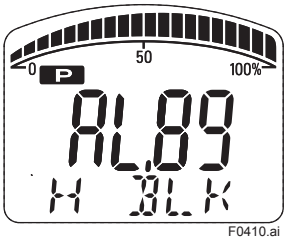


Figure 4.7 Display Example of H Side Blocking

The alarm display on LCD regarding the advanced diagnostic is described in Table 4.5.

NOTE

The alarms of “Invalid Ref xx” and “ILBD over range” do not link to the 4-20 mA analog signal and Status output.

4.2.2.6 Condition Check

After the EJX multivariable transmitter was installed, it is necessary to confirm if **Pres** is stable under the normal operating condition or if fluctuation amplitude under the normal operating condition is large enough to detect the blockage.

■ Stability of Pressure Value

1) Observe the value change of **Pres** under the normal operating condition for 10 minutes.
2) Confirm the value change is less than 10%.

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Detailed setup → Sensors → Pres
DTM (HART 5)	Configuration → Process Input → Pres

If the value change is more than 10%, the error influences pressure fluctuation value so that the blockage detection becomes impossible. Consider the plant operating conditions.

■ Fluctuation Value

NOTE

The blockage detection may not be carried out correctly when pressure fluctuation amplitude especially with the pressure and level measurement, is small.

Confirm that each value of **fDP**, **fSPl**, **fSPh**, and **BlkF** is more than the value specified in the below table.

- Procedure to call up the **fDP**, **fSPl**, **fSPh** display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Diag Parameters → ILBD parameters → Status → Fluct Variables → fDP/fSPl/fSPh
DTM (HART 5)	Diag and Service → Advanced Diag Variables → fDP/fSPl/fSPh

- Procedure to call up the **BlkF** display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Diag Parameters → ILBD parameters → Status → Diag Variables → BlkF
DTM (HART 5)	Diag and Service → Advanced Diag Variables → BlkF

Table 4.4 Requirements to apply ILBD

	Condition
fDP	7×10^{-10} or more
fSPl	1×10^{-10} or more
fSPh	1×10^{-10} or more
BlkF	-0.5 to 0.5

- **fDP is not enough.**

  No blockage can be detected if **fDP** is not larger than the specified value.

- **Only fDP is enough.**

  “A Blocking” or “B Blocking” can be detected if **fSPl** and **fSPh** are not larger than specified values.

- **fDP and fSPl are enough.**

  “H Side Blocking” and “Large Fluct H” can not be detected if **fSPh** is not larger than specified value.

- **fDP and fSPh are enough.**

  “L Side Blocking” and “Large Fluct L” can not be detected if **fSPl** is not larger than specified value.

- **fDP, fSPl and fSPh are enough.**

  All alarm modes can be detected even if **BlkF** is not within the specified values.

4.2.2.7 Obtain Reference Values

The pressure fluctuation values are reduced when the impulse line is plugged. Therefore, the reference value is required to determine the degree of reduction.

IMPORTANT

- If the impulse line is about to be plugged at the time when a reference value is obtained, blockages cannot be detected accurately. The impulse lines on both the high-pressure and low-pressure sides need to be cleaned before a reference value is obtained.
- All air bubbles need to be adequately purged before a reference value is obtained.
- Reference values must be obtained under operating condition.

■ Start of Sampling

The sampling of reference value is carried out for 180 sec, which is the default value set to **Diag Period**.

1) Confirm that the sampling period (**Diag Period**) is set to 180 sec.
2) Set “Reference” to **Diag Mode**.
   The sampling starts soon after the setting.

IMPORTANT

- For the each parameter, the one value is given. If Reference is set to **Diag Mode** again, the value is updated and overwritten.
- If the power supply is shut down during the sampling, **Diag Mode** becomes “Stop”. Set “Reference” to **Diag Mode** in order to carry out the sampling again.

■ End of Sampling

After about 180 sec, the sampling automatically finishes. The “Reference” setting of **Diag Mode** moves automatically to “Calculation”.

Confirm that the setting of **Diag Mode** moves to “Calculation”.

■ Reference Values

Confirm the latest values are obtained into the following parameters.

- **Ref fDP**
- **Ref fSPl**
- **Ref fSPh**
- **Ref BlkF**
- **Ref DPAvg**

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Diag Parameters → ILBD parameters → Status → Diag Reference → Ref fDP/ Ref fSPl/Ref fSPh/Ref BlkF/Ref DPAvg
DTM (HART 5)	Diag and Service → Advanced Diag Configuration → Impulse Line Blockage Detection → Ref fDP/Ref fSPl/Ref fSPh/Ref BlkF/Ref DPAvg

■ Invalid Ref F, SPH, SPL, or DP

When the enough reference fluctuation value is not obtained, an alarm of invalid reference value for each parameter is generated and also the ILBD operation is not carried out.

Confirm the alarm of **Invalid Ref F**, **SPH**, **SPL**, or **DP** is not displayed in **Diag Error**.

If an alarm of **Invalid Ref F**, **SPH**, **SPL**, or **DP** is generated, consider the process condition or obtain the reference fluctuation values again.

NOTE

Even if an alarm of **Invalid Ref F**, **SPH**, **SPL**, or **DP** is generated, “Calculation” in **Diag Mode** is kept.

4.2.2.8 Capability Test of Blockage Detection Operation

Before performing the ILBD operation, check the capability of the blockage detection operation. The simulation test is performed by closing motion of a three-valve manifold or stop valve. When simulated blockage occurs, confirm that an alarm is generated.

NOTE

The fluctuation amplitude of atmospheric pressure is nearly zero with pressure or level measurement. In such case, simulate the blockage detection by closing the valve where the fluctuation existed.

■ Simulation of High-pressure Side Blockage

1) Close the high-pressure-side valve.
2) Confirm the value of **Pres** is stable. If not, open the valve a little.
3) Set “Calculation” to **Diag Mode** so as to start blockage detection operation.
4) Check that an alarm of “H Side Blocking” is generated after the time that consists of **Diag Period** and **Diag Supp Count** passed.
5) Check also the operation of the analog alert if an analog alert is set.
6) Open the valve completely and check that there are no alarms.

■ Simulation of Low-pressure Side Blockage

1) Close the low-pressure-side valve.
2) Confirm the value of **Pres** is stable. If not, open the valve a little.
3) Set “Calculation” to **Diag Mode** so as to start blockage detection operation.
4) Check that an alarm of “L Side Blocking” is generated after the time that consists of **Diag Period** and **Diag Supp Count** passed.
5) Check also the operation of the analog alert if an analog alert is set.
6) Open the valve completely and check that there are no alarms.

■ Simulation of Both-pressure Side Blockage

1) Close the both-pressure-side valves.
2) Confirm the value of **Pres** is stable. If not, open the valve a little.
3) Set “Calculation” to **Diag Mode** so as to start blockage detection operation.
4) Check that an alarm of “B Blocking” is generated in the **Diag Error** after the time that consists of **Diag Period** and **Diag Supp Count** passed.
5) Check also the operation of the analog alert if an analog alert is set.
6) Open the valve completely and check that there are no alarms.

4.2.2.9 Start ILBD Operation

If process condition and capability to detect a blockage are confirmed, you can start the ILBD operation according to the following procedure.

1) Check the value of sampling period (**Diag Period**).
2) Check the number of times that detect the blockage consecutively in order to give an alarm (**Diag Supp Count**). The default value at the shipment is set to 3 times.
3) Set “Calculation” to **Diag Mode**.
   If the reference value has not yet been obtained, set “Reference” to **Diag Mode**. After obtained the reference values, the ILBD starts automatically. At the same time, **Diag Mode** changes automatically from “Reference” to “Calculation”.

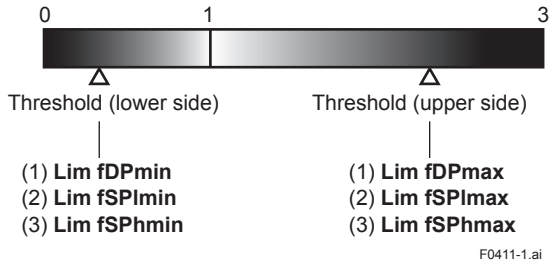
4.2.2.10 Tuning

When the pressure fluctuation amplitude in fluids is not sufficiently large or an alarm is often generated according to the process condition, tune up by changing the threshold for the blockage detection (Limit parameters) or the sampling period (**Diag Period**) to enhance the accuracy of the blockage detection The ILBD operation must be stopped to tune up. Set “Stop” to **Diag Mode**.

■ Threshold Value

The figure below shows the image of tuning effect with a monochrome bar.

(a) The tuning image of the threshold values for
(1) **Ratio fDP**: Sqrt (**fDP/Ref fDP**),
(2) **Ratio fSPl**: Sqrt (**fSPl/Ref fSPl**),
(3) **Ratio fSPh**: Sqrt (**fSPh/Ref fSPh**)



(b) The tuning image of the threshold values for
(4) Sqrt (**BlkF/Ref BlkF**)

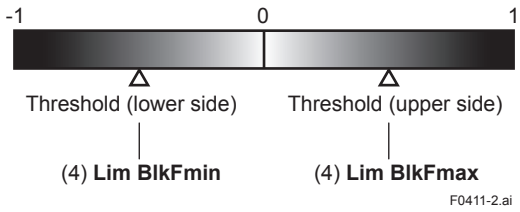


Figure 4.8 Tuning Image of Threshold Value

● Move the threshold toward the white.

- It becomes increasingly likely to give a false alarm due to the disturbance from environment change.
- If flow/differential pressure is below **Lim DPAvgmin** or exceeds **Lim DPAvgmax**, pressure fluctuation is likely too small or too large to detect the blockage.

● Move the threshold toward the black.

- It enables to be insusceptible to disturbance such as environment change and to detect the blockage easier.
- It becomes giving an alarm of the blockage after the blockage has been progressed.

(1) For DD (HART 5/HART 7) and DTM (HART 7)

- Procedure to call up the **threshold** related display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Diag Parameters → ILBD parameters → Configuration → Diag Lim →

The default values at the factory setting are the values of **Lim fDPmax** to **Lim BlkFmin** shown in Table 4.3.

Change the threshold value to solve your problem according to the above image.

1) Set “Stop” to **Set Diag Mode**.
2) Change the unsuitable value of **Diag Lim** parameters corresponding to the each blockage detection.

Note: Set to “Calculation” after setting the parameter.

Limit parameter

#	Parameter	Threshold value
[1]	Lim fDPmax	Threshold to detect “A Blocking” by using **Ratio fDP**
[2]	Lim fDPmin	Threshold to detect “B Blocking” by using **Ratio fDP**
[3]	Lim fSPlmax	Threshold to detect “Large Fluct L” by using **Ratio fSPl**
[4]	Lim fSPlmin	Threshold to detect “L Side Blocking” by using **Ratio fSPl**
[5]	Lim fSPhmax	Threshold to detect “Large Fluct H” by using **Ratio fSPh**
[6]	Lim fSPhmin	Threshold to detect “H Side Blocking” by using **Ratio fSPh**
[7]	Lim BlkFmax	Threshold to detect “H Side Blocking” by using **BlkF**
[8]	Lim BlkFmin	Threshold to detect “L Side Blocking” by using **BlkF**

(2) For DTM (HART 5)

Combination of threshold depend on the sensitivity of blockage detection can be selected from High, Medium, or Low in the **Sensitivity** parameter.

- Procedure to call up the display

DTM (HART 5)	Diag and Service → Advanced Diag Configuration → Impulse Line Blockage Detection → Threshold → sensitivity

When select “Custom” in the Sensitivity parameter, you can set each threshold individually.
Set the **Diag Mode** to “Stop” before changing the threshold.

Combination of threshold for sensitivity parameter

	High	Medium	Low
Lim fDPmax	1.50	3.00	3.00
Lim fDPmin	0.40	0.30	0.20
Lim fSPlmax	5.00	5.00	5.00
Lim fSPlmin	0.50	0.50	0.30
Lim fSPhmax	5.00	5.00	5.00
Lim fSPhmin	0.50	0.50	0.30
Lim BlkFmax	0.60	0.60	0.80
Lim BlkFmin	-0.60	-0.60	-0.80

■ Sampling Period

If fluctuating around the threshold value, an alarm maybe often generated. When the above phenomenon happens, the sampling time (**Diag Period**) can be changed so as to enhance the accuracy of the blockage detection.

The longer the sampling time, better the expected accuracy.

(1) Set “Stop” to **Diag Mode**.

(2) Enter the value to **Diag Period** within the range of 20 to 65535 (sec).

Note: Set to “Calculation” after setting the parameter.

Also, the accuracy can be improved by increasing the number of **Diag Supp Count**.

■ ILBD Range Setting

If flow/differential pressure is less than the default threshold value of **Lim DPAvgmin**, pressure fluctuation is not large enough to detect the blockage. To prevent the fault blockage detection, the threshold should be changed to larger value.

(1) Set “Stop” to **Diag Mode**.

(2) Enter the value to **Lim DPAvgmin** or **Lim DPAvgmax**.

Note Set to “Calculation” after setting the parameter.

- Procedure to call up the **threshold** display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Diag Parameters → ILBD parameters → Configuration → Diag Lim →
DTM (HART 5)	Diag and Service → Advanced Diag Configuration → Impulse Line Blockage Detection → Threshold →

■ Ratio fDP Compensation

When the flow change is too large or small, an alarm maybe often generated. When the above case happens, the Ratio fDP can be compensated so as to enhance the accuracy of the blockage detection.

● Diag DPComp

When “Compensation” is selected in **Diag DPComp**, **Ratio fDP** is compensated by following formula and used as treatable monitoring value, **CRatio fDP**.

$$\text{CRatio fDP} = \sqrt{\frac{\text{fDP}}{\text{Ref fDP}}} \times \left| \frac{\text{Ref DPAvg}}{\text{DPAvg}} \right|$$

On the other hand, if the compensation is not necessary, “Non-compensation” is selected in **Diag DPComp** and **Ratio fDP** is used as **NRatio fDP**.

$$\text{NRatio fDP} = \sqrt{\frac{\text{fDP}}{\text{Ref fDP}}}$$

- Procedure to call up the display

DD (HART 5/7) DTM (HART 7)	**[Root Menu]** → Diag/Service → Diag Parameters → ILBD parameters → Status → Diag Vriables → CRatio fDP/NRatio fDP
DTM (HART 5)	Diag and Service → Advanced Diag Configuration → Impulse Line Blockage Detection → Threshold →

4.2.2.11 Reset of Reference Value

When there are large flow change or the change of fluid conditions, obtain the reference value again. If flow change by a comparison of the reference value is ±25% or more, obtain the reference value again.

4.2.2.12 ILBD Parameter List

#	Parameter name	Default value	Explanation
1	Diag Error	0x0000	The results detected by ILBD or Heat trace monitoring are stored into this parameter. Also the condition abnormality in the diagnostic process is stored as an error.
2	Diag Option	0x08FC	The masking in this parameter enable to display each error message and the status to the output signal or LCD. The error assigned to each bit is corresponding to that of **Diag Error**. Writable only when Diag Mode is "Stop".
3	Diag Out Option	Off	Output mode of 4-20mA when an advanced diagnostic alarm is generated. There are following three output modes; Off, Burnout, or Fall back.
4	Diag Fixed Out Val	21.6 mA	Parameter for "Fall back" function in the Diag Out option. The output value of 4-20 mA analog signal is specified when an alarm is generated. The value can be entered within 3.8 to 21.6 mA.
5	DO Select	Off	The variables for status output are specified to this parameter. When the advanced diagnostic function (option code /DG6) is installed, the parameters monitoring in diagnostic process can be also assigned to the status output.
6	Diag Mode	Stop	The operation mode of ILBD is set. Stop: The blockage detection is stopped. Calculate: The blockage detection is carried out. The alarms are generated along with the detected result. Reference: The reference values are obtained and the update values are overwritten. After setting, this mode moves automatically to "Calculation".
7	Diag Period	180 (sec)	The data acquisition period for ILBD is set within 20 to 65535 (sec). If the process fluctuation values are unsteady, this value is changed to the longer to enhance the accuracy of the blockage detection. Writable only when Diag Mode is "Stop".
8	Diag Supp Count	3	Detection count to generate an alarm. When the statistical value as **Ratio fDP** and **BlkF** exceeds consecutively the threshold by number of times preset to this parameter, it is estimated that the impulse line is plugged.
9	Diag Description		Memo field. 32 alphanumerics
10	fDP		Average value of the sum of squares of differential pressure fluctuation.
11	fDP Status		Status of **fDP**
12	fSPl		Average value of the sum of squares of low-pressure-side static pressure fluctuation. For gauge/absolute pressure transmitter, 0 is set.
13	fSPl Status		Status of **fSPl**
14	fSPh		Average value of the sum of squares of high-pressure-side static pressure fluctuation. For gauge/absolute pressure transmitter, 0 is set.
15	fSPh Status		Status of **fSPh**
16	BlkF		Blockage degree characterized in comparison of high- and low-pressure side pressure fluctuation value.
17	BlkF Status		Status of **BlkF**
18	DPAvg		Ratio of the average of differential pressure/pressure to the maximum span of an EJX transmitter.
19	DPAvg Status		Status of **DPAvg**
20	Ratio fDP		**CRatio fDP** or **NRatio fDP** is used by **Diag Comp** setting. **fDP** decreases and this parameter is used to determine whether one or both sides are plugged.
21	Ratio fDP Status		Status of **Ratio fDP**
22	Ratio fSPl		SQRT (**fSPl/Ref fSPl**). **fSPl** decreases and this parameter is used to determine whether low-pressure-side is plugged.
23	Ratio fSPl Status		Status of **Ratio fSPl**
24	Ratio fSPh		SQRT (**fSPh/Ref fSPh**). **fSPh** decreases and this parameter is used to determine whether high-pressure-side is plugged.
25	Ratio fSPh Status		Status of **Ratio fSPh**
26	Ref fDP		Value of **fDP** obtained under normal condition.
27	Ref fDP Status		Status of **fDP** obtained under normal condition.

#	Parameter name	Default value	Explanation
28	Ref fSPl		Value of **fSPl** obtained under normal condition.
29	Ref fSPl Status		Status of **fSPl** obtained under normal condition.
30	Ref fSPh		Value of **fSPh** obtained under normal condition.
31	Ref fSPh Status		Status of **fSPh** obtained under normal condition.
32	Ref BlkF		Value of **BlkF** obtained under normal condition.
33	Ref BlkF Status		Status of **BlkF** obtained under normal condition.
34	Ref DPAvg		Value of **DPAvg** obtained under normal condition.
35	Ref DPAvg Status		Status of **DPAvg** obtained under normal condition.
36	Lim fDPmax	Refer to Table 4.3	Upper limit for **Ratio fDP** to detect the blockage. Writable only when **Diag Mode** is "Stop".
37	Lim fDPmin		Lower limit for **Ratio fDP** to detect the blockage. Writable only when **Diag Mode** is "Stop".
38	Lim fSPlmax		Upper limit for **Ratio fSPl** to detect the blockage. Writable only when **Diag Mode** is "Stop".
39	Lim fSPlmin		Lower limit for **Ratio fSPl** to detect the blockage. Writable only when **Diag Mode** is "Stop".
40	Lim fSPhmax		Upper limit for **Ratio fSPh** to detect the blockage. Writable only when **Diag Mode** is "Stop".
41	Lim fSPhmin		Lower limit for **Ratio fSPh** to detect the blockage. Writable only when **Diag Mode** is "Stop".
42	Lim BlkFmax		Upper limit for **BlkF** to detect the blockage. Writable only when **Diag Mode** is "Stop".
43	Lim BlkFmin		Lower limit for **BlkF** to detect the blockage. Writable only when **Diag Mode** is "Stop".
44	Lim DPAvgmax		Upper limit for **DPAvg**. Writable only when **Diag Mode** is "Stop".
45	Lim DPAvgmin		Lower limit for **DPAvg**. Writable only when **Diag Mode** is "Stop".
46	Ref Lim fDPmin	7.0E-10	Lower limit to judge whether **Ref fDP** is available for ILBD operation. Writable only when Diag Mode is "Stop".
47	Ref Lim fSPmin	1.0E-10	Lower limit to judge whether **Ref fSPl** and **Ref fSPh** are available for ILBD operation. Writable only when Diag Mode is "Stop".
48	Ref Lim BlkFmax	0.5	Upper limit to judge whether **Ref BlkF** is available for ILBD operation. Writable only when Diag Mode is "Stop".
49	Status group 9		Refer to Table 4.5.
50	Status group 10		Refer to Table 4.5.
51	CRatio fDP		**Ratio fDP** is compensated by following formula and used as treatable monitoring value when the flow change is too large or small. Sqrt (**fDP / Ref fDP**) X | **Ref DPAvg / DPAvg** | When compensation is selected in **Diag DP Comp**, **CRatio fDP** is used as monitoring value.
52	CRatio fDP Status		Status of **CRatio fDP**
53	NRatio fDP		When Non-compensation is selected in **Diag DP Comp**, NRatio fDP is used as monitoring value. **NRatio fDP** = Sqrt (**fDP / Ref fDP**)
54	NRatio fDP Status		Status of **NRatio fDP**
55	Diag DPComp	0: Compensation	Whether **fDP** is referred by **CRatio fDP** or **NRatio fDP** is selected.
56	Diag Applicable		After the reference value is obtained, the applicable blockage detection is displayed on this parameter.

4.2.3 Heat Trace Monitoring

The EJX multivariable transmitter with Heat trace monitoring function calculates the flange temperature by using the two temperature sensors built in the EJX multivariable transmitter.

An analog alert is generated if the temperature reached to the preset level.

The flange temperature is based on the following parameters and calculation formula.

[Parameters]

Parameter name	Explanation
Cap temp (CT)	Measured capsule temperature value
Amp temp (AT)	Measured amplifier temperature value
Flg temp (FT)	Flange temperature value (Calculated value)
Flg temp Coef (Cf)	Coefficient to calculate flange temperature
Flg temp Hi Alert Val	Threshold to generate FT high alarm
Flg temp Lo Alert Val	Threshold to generate FT low alarm

[Calculation formula]

Flg temp (FT) = CT + Cf X (CT-AT)

If the flange temperature exceeds the value preset to **Flg temp Hi Alert Val** or **Flg temp Lo Alert Val**, an alert is generated.

NOTE

The flange temperature is calculated by the calculation formula assumed that the capsule part of EJX multivariable transmitter is heated up or kept warm by an electrical heater or steam. In the case of an atmosphere temperature or less, the difference of temperature of approximately 3 to 4 °C, may occur because the amplifier temperature becomes higher than the capsule temperature.

4.2.3.1 Flg Temp Coef Setting

The value calculated according to the following procedure is set to **Flg temp Coef**.

- To enhance the calculation accuracy of the flange temperature, measure the actual flange temperature by using the temperature sensor etc.
- Calculate the ratio of the capsule temperature to the capsule temperature minus the amplifier temperature from the two temperature values measured by EJX multivariable transmitter.
- Derive the **Flg temp Coef** from the measured flange temperature and the ratio of the capsule temperature to the amplifier temperature in accordance with the following calculation formula.

Flg temp Coef (Cf) =

$$\frac{\textit{(Actual measured value of Flange temperature) - CT}}{\textit{CT - AT}}$$

For DTM (HART 5), Flg Temp Coef parameter can be set by using Tuning function.
By setting the measured value of flange temperature, Flg Temp Coef is calculated by using capsule temperature and amplifier temperature.

- Procedure to call up the **Tuning** display.

Diag and Service → Advanced Diag Configuration → Heat Trace → Tuning

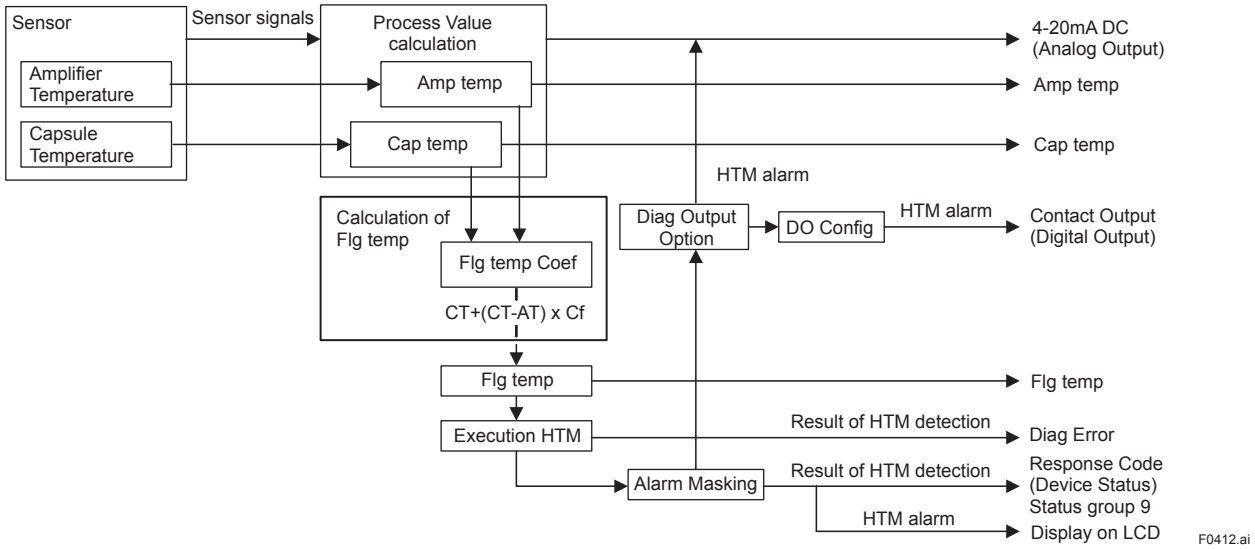
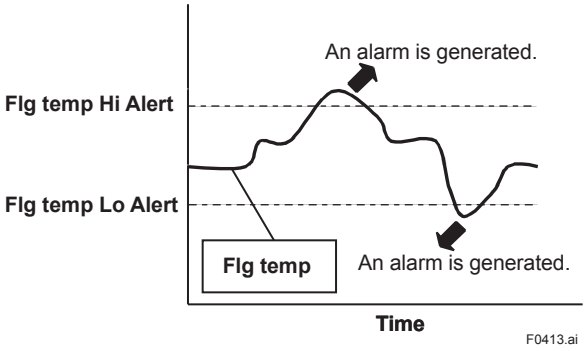


Figure 4.9 Functional Block Diagram of Heat Trace Monitoring (HTM)

4.2.3.2 Out of Temperature Measurement Range

When the flange temperature is out of measurement range, the alarm or alert is generated. For the detail of alarm and alert setting, refer to subsection 4.2.2.5.

The measurement range is set to **Flg temp Hi Alert Val** and **Flg temp Lo Alert Val**, which values can be specified within -50 to 130 deg C.



4.2.3.3 Parameter Lists for Heat Trace Monitoring

#	Parameter name	Default value	Explanation
1	Diag Error	0x0000	The results detected by ILBD or Heat trace monitoring are stored into this parameter. Also the condition abnormality in the diagnostic process is stored as an error.
2	Diag Option	0x08FC	The masking in this parameter enable to display each error message and the status to the output signal or LCD. The error assigned to each bit is corresponding to that of Diag Error. Writable only when Diag Mode is "Stop".
3	Diag Out Option	Off	The error status can be output by 4-20 mA analog signal. There are following three output modes; Off, Burnout, or Fall back.
4	Diag Fixed Out Val	21.6mA	Parameter for "Fall back" function in the Diag Out option. The output value in 4-20 mA analog signal is specified when an alarm is generated. The value must be entered within 3.8 to 21.6 mA.
5	Cap temp		Measured capsule temperature value
6	Amp temp		Measured Amplifier temperature value
7	Flg temp	(Note)	Calculated flange temperature value
8	Flg temp Coef	0	Coefficient to calculate flange temperature (Cf: Rt_1/Rt_2) Rt_1: Thermal resistance between the flange and capsule. Rt_2 : Thermal resistance between the cupsule and amplifier.
9	Flg temp Hi Alarm Val	120 deg C	Upper limit of **Flg temp**
10	Flg temp Lo Alarm Val	-40 deg C	Lower limit of **Flg temp**
11	DO Select	Off	See subsection 3.3.12 Status Output
12	DO Signal type	ON WHEN AL DETECT	See subsection 3.3.12 Status Output
13	Digital Output	Off	See subsection 3.3.12 Status Output

Note: The **Flg temp Coef** is 0 at the shipment so that the **Flg temp** outputs the same value as that of **Cap temp**.

4.3 Alarms and Countermeasures

Table 4.5 Alarm Message Summary

Integral indicator	HART configuration tool display	Cause	4-20mA Output operation during error	Countermeasure	Status group *1	Diagnostic List group *2
AL. 01 CAP.ERR	**P sensor error *1 Pressure Sensor Error *2**	Sensor problem.	Outputs the signal (High or Low) set with burnout direction switch. [status output: undefined] (About the output signal, refer to subsection 3.3.9)	Replace capsule if the error recurs after the transmitter is restarted.	1	Hardware Failure
	CT sensor error *1 Capsule Temperature Sensor Error *2	Capsule temperature sensor problem.		Replace capsule.		
	Cap EEPROM error *1 Capsule EEPROM Error *2	Capsule EEPROM problem.				
AL. 02 AMP.ERR	**AT sensor error *1 Amp Temp Sensor Error *2**	Amplifier temperature sensor problem.		Replace amplifier.		
	Amp EEPROM error *1 Amp EEPROM Error *2	Amplifier EEPROM problem.				
	CPU board error *1 CPU Board Error *2	Amplifier problem.			2	
	AD Converter Error *1 A/D Converter Error *2	A/D Converter problem.			4	
AL. 03 ET.ERR	**ET sensor error *1 External Temp Sensor Error *2**	External temperature sensor disconnection.		Check external temperature sensor.		
—	**No device ID *1 No Device ID *2**	No device ID is found.	Continues to operate and output.	Replace amplifier.	2	
AL. 10 PRESS	**P outside limit *1 Pressure Outside Limit *2**	Differential pressure is outside measurement range limit of capsule.	When PV is Pres Output AO upper limit or AO Lower limit. (Refer to subsection 3.3.1)	Check input or replace capsule when necessary.	3	Transducer Status
AL. 11 ST. PRSS	**SP outside limit *1 Static Pressure Outside Limit *2**	Static pressure exceeds limit.	When PV is SP Output AO upper limit or AO Lower limit. (Refer to subsection 3.3.1)			
AL. 12 CAP.TMP	**CT outside limit *1 Cap Temp Outside Limit *2**	Capsule temperature is outside range (–50 to 130°C).	Continues to operate and output.	Use heat insulation or make lagging to keep temperature within range.		
AL. 13 AMP.TMP	**AT outside limit *1 Amp Temp Outside Limit *2**	Amplifier temperature is outside range (–50 to 95°C).				
AL. 14 EXT. TMP	**ET outside limit *1 External Temp Outside limit *2**	External temperature is outside range.	When PV is ET Output AO upper limit or AO Lower limit. (Refer to subsection 3.3.1)			
AL. 15 EXT. TMP	**OHM outside limit *1 OHM Outside limit *2**	External temperature sensor resistance is out specification.				
AL. 16 PLS	**PLS outside limit *1 PLS RNG Outside Limit *2**	Pulse output is out specification.	Continues to operate and output.	Check settings and change them.		

*1: DD (HART 5/HART 7), DTM (HART 7)
*2: DTM (HART 5)
*3: Available only for HART 7

Integral indicator	HART configuration tool display	Cause	4-20mA Output operation during error	Countermeasure	Status group *1	Diagnostic List group *2
AL. 30 PRS.RNG	**P over range *1 Pressure Over Range *2**	Differential pressure exceeds specified range.	When PV is Pres. Output AO upper limit or lower limit. (Refer to subsection 3.3.1)	Check input and range setting, and change them as needed.	4	Transducer Status
AL. 31 SP. RNG	**SP over range *1 Static Pressure Over Range *2**	Static pressure exceeds specified range.	When PV is SP Output AO upper limit or lower limit. (Refer to subsection 3.3.1)			
AL. 32 F. RNG	**F over range *1 Flow Over Range *2**	Flow exceeds specified range.	When PV is Flow Output AO upper limit or lower limit. (Refer to subsection 3.3.1)			
AL. 33 ET. RNG	**ET over range *1 External Temp Over Range *2**	External temperature exceeds specified range.	When PV is ET Output AO upper limit or lower limit. (Refer to subsection 3.3.1)			
AL. 35 P.HI	**P high alarm *1 Pressure High Alarm *2**	Input pressure exceeds specified threshold.	Continues to operate and output.	Check input.	5	
AL. 36 P.LO	**P low alarm *1 Pressure Low Alarm *2**					
AL. 37 SP.HI	**SP high alarm *1 Static Pressure High Alarm *2**	Input static pressure exceeds specified threshold.				
AL. 38 SP.LO	**SP low alarm *1 Static Pressure Low Alarm *2**					
AL. 41 F.HI	**F high alarm *1 Flow High Alarm *2**	Input flow exceeds specified threshold.			8	
AL. 42 F.LO	**F low alarm *1 Flow Low Alarm *2**					
AL. 43 ET.HI	**ET high alarm *1 External Temp High Alarm *2**	Input external temperature exceeds specified threshold.				
AL. 44 ET.LO	**ET low alarm *1 External Temp Low Alarm *2**					
AL. 50 P. LRV	**Illegal P LRV *1 Illegal Pressure LRV *2**	Specified value is outside of setting range.	Holds at the output value that existed immediately before the error occurred.	Check settings and change them as needed.	6	Configuration
AL. 51 P. URV	**Illegal P URV *1 Illegal Pressure URV *2**					
AL. 52 P. SPN	**Illegal P SPAN *1 Illegal Pressure SPAN *2**					
AL. 53 P. ADJ	**P SPAN trim err *1 Pressure SPAN Trim Error *2**		Continues to operate and output.	Adjust settings and change them as needed.		
	P ZERO trim err *1 Pressure ZERO Trim Error *2					
AL. 54 SP. RNG	**Illegal SP LRV *1 Illegal Static Pressure LRV *2**		Holds at the output value that existed immediately before the error occurred.	Check settings and change them as needed.		
	Illegal SP URV *1 Illegal Static Pressure URV *2					
	Illegal SP SPAN *1 Illegal Static Pressure SPAN *2					

*1: DD (HART 5/HART 7), DTM (HART 7)
*2: DTM (HART 5)
*3: Available only for HART 7

Integral indicator	HART configuration tool display	Cause	4-20mA Output operation during error	Countermeasure	Status group *1	Diagnostic List group *2
AL. 55 SP. ADJ	**SP SPAN trim err *1 Static Pressure SPAN Trim Error *2**	Specified value is outside of setting range.	Continues to operate and output.	Adjust settings and change them as needed.	7	Configuration
	SP ZERO trim err *1 Static Pressure ZERO Trim Error *2					
AL. 56 ET. RNG	**Illegal ET LRV *1 Illegal External Temp LRV *2**		Holds at the output value that existed immediately before the error occurred.	Check settings and change them as needed.	8	
	Illegal ET URV *1 Illegal External Temp URV *2					
	Illegal ET SPAN *1 Illegal External Temp SPAN *2					
AL. 57 ET. ADJ	**ET SPAN trim err *1 External Temp SPAN Trim Error *2**		Continues to operate and output.	Adjust settings and change them as needed.	7	
	ET ZERO trim err *1 External Temp ZERO Trim Error *2					
AL. 58 FL. ADJ	**F set outside Range *1 Flow set Outside Range *2**	Specified value is outside of setting range.	Holds at the output value that existed immediately before the error occurred.	Check settings and change them as needed.	8	
AL. 59 PLS.ADJ	**PLS set err *1, *2**	Specified value is outside of setting pulse output.	Normal calculation.		7	
—	**ET Fixed Mode *1, *2**	Under Temperature Fix Mode. PV is ET	Temp. Output Fix at 4mA.	Leave from Temperature Fix Mode.	7	
AL. 79 OV. DISP	**—**	Displayed value exceeds limit.	Continues to operate and output.	Check settings and change them as needed.	—	Diag Status
AL.87 FLG. HI	**FT high alarm *1 Flg Temp High Alarm *2**	Flange temperature exceeds a preset upper limit.	It depends on the Diag Out Option setting. Off: Continue to operate and output. Burnout:Outputs AO upper limit or AO lower limit. Fall back:Outputs Diag Out Fixed Val.	Check the heater failure. Check the capsule temp. and Amplifier temp. Adjust Flg Temp Coef.	9	
AL.87 FLG. LO	**FT low alarm *1 Flg Temp Low Alarm *2**	Flange temperature is below a preset lower limit.				
AL.88 INVR.DP	**Invalid Ref DP *1 Invalid Ref fDP *2**	Differential pressure/ pressure fluctuation does not reach the reference level required to blockage detection so that no blockage detection is carried out.	Continue to operate and output.	Check process condition.		
AL.88 INVR.SL	**Invalid Ref SPL *1 Invalid Ref fSPl *2**	Low-pressure-side fluctuation does not reach the reference fluctuation level required to blockage detection.				
AL.88 INVR.SH	**Invalid Ref SPH *1 Invalid Ref fSPh *2**	High-pressure-side fluctuation does not reach the reference fluctuation level required to blockage detection.				
AL.88 INVR.F	**Invalid Ref F *1 Invalid Ref BlkF *2**	BlkF can not be used for blockage detection for some reasons.				
AL.89 ILBD.OV	**ILBD over range *1 Outside Diagnosis Range *2**	Appointed the diagnosis range outside.				

*1: DD (HART 5/HART 7), DTM (HART 7)
*2: DTM (HART 5)
*3: Available only for HART 7

Integral indicator	HART configuration tool display	Cause	4-20mA Output operation during error	Countermeasure	Status group *1	Diagnostic List group *2
AL.89 B BLK	**B Blocking *1, *2**	B Blocking (both-side blockage) is detected.	It depends on the Diag Out Option setting. Off: Continue to operate and output. Burnout: Outputs AO upper limit or AO lower limit. Fall back: Outputs Diag Out Fixed Val.	Check process condition.	10	Diag Status
AL.89 H BLK	**H Side Blocking *1 High Side Blocking *2**	High-pressure-side blockage is detected.				
AL.89 L BLK	**L Side Blocking *1 Low Side Blocking *2**	Low-pressure-side blockage is detected.				
AL.89 H LRG	**Large Fluct H *1 Large Fluctuation of High Side *2**	Pressure fluctuation amplitude of high-pressure side is large.				
AL.89 L LRG	**Large Fluct L *1 Large Fluctuation of Low Side *2**	Pressure fluctuation amplitude of low-pressure side is large.				
AL.89 A BLK	**A Blocking *1, *2**	A Blocking (single-side blockage) is detected.				
AL. 90 SIM	**Flow Simulation mode *3 Simulation mode *4**	Under Simulation Mode for flow.	Simulate input output.	Check Simulation Mode.	5	Transducer Status
AL. 91 *3 F. SIM	**F Simulate Mode**	Under Simulation Mode for device variables.	Output the setting value of Simulate-Value	Check Simulation Mode	11	—
AL. 91 *3 P. SIM	**P Simulate Mode**					
AL.91 *3 SP. SIM	**SP Simulate Mode**					
AL. 91 *3 ET. SIM	**ET Simulate Mode**					
AL. 91 *3 TF. SIM	**TF Simulate Mode**					
AL. 91 *3 PCT. SIM	**% Simulate Mode**					
AL. 91 *3 AO. SIM	**AO Simulate Mode**					

*1: DD (HART 5/HART 7), DTM (HART 7)
*2: DTM (HART 5)
*3: Available only for HART 7
*4: HART 5

Table 4.6 HART Configuration Tool Error Messages

Error message	Probable cause	Countermeasure
Invalid selection	—	Change the setting.
Passed Parameter Too Large	Set value is too high.	
Passed Parameter Too Small	Set value is too low.	
Too Few Data Bytes Received	—	—
In Write Protect Mode	Operation is set in the Write Protect mode.	—
Lower Range Value too High	LRV set point is too high.	Change the range.
Lower Range Value too Low	LRV set point is too low.	
Upper Range Value too High	URV set point is too high.	
Upper Range Value too Low	URV set point is too low.	
Span too Small	Set span is too small.	
Applied Process too High	Applied pressure is too high.	Adjust the applied pressure.
Applied Process too Low	Applied pressure is too low.	
New Lower Range Value Pushed Upper Range Value Over Sensor Limit	The shift of URV according to the new LRV setting exceeds USL.	Change the URV setting within the range of USL.
Excess Correction Attempted	Amount of correction is too much.	Adjust the amount.
Small Char. did not convert successfully	Characters are not convertible. e.g. %	Correct the setting.
Not in fixed current mode	The fixed current mode is desired but not set in that mode.	Set in the fixed current mode.
In Multidrop Mode	Operation is set in the multi-drop mode.	—
Not write Protect	Operation is set without a password.	—

Table 4.7 Device Status

Item	Description
Field Device Malfunction (0x80)	Field device has malfunctioned due to a hardware error or failure.
Configuration Changed (0x40)*	A modification has been made to the configuration of the field device.
Cold Start (0x20)	A reset of the field device has occurred, or power has been removed and reapplied.
More Status Available (0x10)	Field device has more status available.
PV Analog Output Fixed (0x08)	Analog output 1 and its digital representation are in fixed mode, and not responsive to input changes.
PV Analog Output saturated (0x04)	Analog output 1 and its digital representation are outside the operating range limits, and not responding to input.
Non-PV out of Limits (0x02)	Process applied to the non-primary variable is outside the operating limits of the field device.
PV out of Limits (0x01)	Process applied to the primary variable is outside the operating limits of the field device.

*: This flag can be reset. Refer to subsection 4.1.3 (6) Reset Configuration Changed Flag

Table 4.8 Extended Device Status

Item	Description
Maintenance Required (0x01)	Device requires maintenance.
Device Variable Alert (0x02)	Configuration is invalid or device is under simulation mode.

Table 4.9 Data Quality and Limit Status

Data Quality	Description
Good	The value may be used in control.
Poor Accuracy	The quality of the value is less than normal, but the value may still be useful.
Manual / Fixed	The value is manually fixed.
Bad	The value is not useful.

Limit Status	Description
Constant	The value cannot be changed, no matter what the process does.
Low Limited	The value is out of the high or low limit.
High Limited	
Not Limited	The value is free to change.

Table 4.10 Relationship between Alarm and Status available for HART 7

Integral Indicator	HART configuration tool display	Device Status	Extended Device Status	Value and Status (Data Quality and Limit Status)						
				Flow	Differential Pressure (DP)	Static Pressure (SP)	External Temperature (ET)	Total Flow	% range	Loop current
AL.01 CAP.ERR	P sensor error	Device Malfunction (0x80)	Maintenance Required (0x01)	Value: Hold value Status: Bad and Constant					Value:Hold value Status:Bad and Low Limited/High Limited*1	
	CT sensor error			Value: Hold value Status: Bad and Constant						
	Cap EEPROM error			Value: Hold value Status: Bad and Constant						
AL.02 AMP.ERR	AT sensor error			Value: Hold value Status: Bad and Constant					Value: Hold value Status: Bad and Low Limited/High Limited*1	
	Amp EEPROM error			Value: Hold value Status: Bad and Constant						
	CPU board error			Value: Hold value Status: Bad and Constant						
	AD Converter error			Value: Hold value Status: Bad and Constant						
AL.03 ET. ERR	ET sensor error			Value: Hold value Status: Bad and Constant					Value: Hold value Status: Bad and Low Limited/High Limited*1	
---	No device ID	---	---	Value: Measured value Status: Good and Not Limited						
AL.10 PRESS	P outside limit	In the case of PV: Primary Variable Out of Limits (0x01) In the case except PV: Non-Primary Variable Out of Limits (0x02)	Device Variable Alert (0x02)	Value: Measured value Status: Poor Accuracy and Not Limited	Value: Measured value Status: Poor Accuracy and Not Limited		Value: Measured value Status: Good and Not Limited	Value: Measured value Status: Poor Accuracy and Not Limited	Same as Value and Status of PV	
AL.11 ST.PRSS	SP outside limit									
AL.12 CAP.TMP	CT outside limit	Non-Primary Variable Out of Limits (0x02)								
AL.13 AMP.TMP	AT outside limit			Value: Measured value Status: Good and Not Limited						
AL.14 EXT.TMP	ET outside limit	In the case of PV: Primary Variable Out of Limits (0x01) In the case except PV: Non-Primary Variable Out of Limits (0x02)		Value: Measured value Status: Poor Accuracy and Not Limited	Value: Measured value Status: Good and Not Limited		Value: Measured value Status: Poor Accuracy and Not Limited	Value: Measured value Status: Poor Accuracy and Not Limited	Same as Value and Status of PV	
AL.15 EXT.TMP	OHM outside limit									
AL.16 PLS	PLS outside limit	---		Value: Measured value Status: Good and Not Limited						

*1: Depend on the setting of hardware switch
*2: Depend on the direction of range over (high or low)

Integral Indicator	HART configuration tool display	Device Status	Extended Device Status	Value and Status (Data Quality and Limit Status)						
				Flow	Differential Pressure (DP)	Static Pressure (SP)	External Temperature (ET)	Total Flow	% range	Loop current
AL.30 PRS.RNG	P over range	In the case of PV: Loop Current Saturated (0x04)	Device Variable Alert (0x02)	Value: Measured value Status: Good and Not Limited					In the case of PV Value: Hold value Status: Bad and Low Limited/High Limited*2 In the case except PV Value: Measured value Status: Good and Not Limited	
AL.31 SP. RNG	SP over range									
AL.32 F. RNG	F over range									
AL.33 ET. RNG	ET over range									
AL.35 P. HI	P high alarm	---		Value: Measured value Status: Good and Not Limited						
AL.36 P. LO	P low alarm									
AL.37 SP. HI	SP high alarm									
AL.38 SP. LO	SP low alarm									
AL.41 F. HI	F high alarm									
AL.42 F. LO	F low alarm									
AL.43 ET. HI	ET high alarm									
AL.44 ET. LO	ET low alarm									
AL.50 P. LRV	Illegal P LRV			Value: Measured value Status: Good and Not Limited					In the case PV is DP Value: Hold value Status: Bad and Constant In the case except shown above Value: Measured value Status: Good and Not Limited	
AL.51 P. URV	Illegal P URV									
AL.52 P. SPN	Illegal P SPAN									
AL.53 P. ADJ	P SPAN trim err			Value: Measured value Status: Poor Accuracy and Not Limited	Value: Measured value Status: Poor Accuracy and Not Limited	Value: Measured value Status: Good and Not Limited		Value: Measured value Status: Poor Accuracy and Not Limited	In the case PV is DP or Flow Value: Measured value Status: Poor Accuracy and Not Limited In the case except shown above Value: Measured value Status: Good and Not Limited	
	P ZERO trim err									
AL.54 SP. RNG	Illegal SP LRV			Value: Measured value Status: Good and Not Limited					In the case PV is SP Value: Hold value Status: Bad and Constant In the case except shown above Value: Measured value Status: Good and Not Limited	
	Illegal SP URV									
	Illegal SP SPAN									

*1: Depend on the setting of hardware switch
*2: Depend on the direction of range over (high or low)

Integral Indicator	HART configuration tool display	Device Status	Extended Device Status	Value and Status (Data Quality and Limit Status)						
				Flow	Differential Pressure (DP)	Static Pressure (SP)	External Temperature (ET)	Total Flow	% range	Loop current
AL.55 SP. ADJ	SP SPAN trim err	---	Device Variable Alert (0x02)	Value: Measured value Status: Poor Accuracy and Not Limited	Value: Measured value Status: Good and Not Limited	Value: Measured value Status: Poor Accuracy and Not Limited	Value: Measured value Status: Good and Not Limited	Value: Measured value Status: Poor Accuracy and Not Limited	In the case PV is SP or Flow Value: Measured value Status: Poor Accuracy and Not Limited In the case except shown above Value: Measured value Status: Good and Not Limited	
	SP ZERO trim err									
AL.56 ET. RNG	Illegal ET LRV			Value: Measured value Status: Good and Not Limited					In the case PV is ET Value: Hold value Status: Bad and Constant In the case except shown above Value: Measured value Status: Good and Not Limited	
	Illegal ET URV									
	Illegal ET SPAN									
AL.57 ET. ADJ	ET SPAN trim err			Value: Measured value Status: Poor Accuracy and Not Limited	Value: Measured value Status: Good and Not Limited		Value: Measured value Status: Poor Accuracy and Not Limited	Value: Measured value Status: Poor Accuracy and Not Limited	In the case PV is ET or Flow Value: Measured value Status: Poor Accuracy and Not Limited In the case except shown above Value: Measured value Status: Good and Not Limited	
	ET ZERO trim err									
AL.58 FL. ADJ	F set outside Range			Value: Measured value Status: Good and Not Limited					In the case PV is Flow Value: Hold value Status: Bad and Constant In the case except shown above Value: Measured value Status: Good and Not Limited	
AL.59 PLS.ADJ	PLS set err			Value: Measured value Status: Good and Not Limited						
---	ET Fixed Mode	---	---	Value: Measured value Status: Good and Not Limited			Value: Hold value Status: Good and Constant	Value: Measured value Status: Good and Not Limited	In the case PV is ET Value: Hold value Status: Good and Constant In the case except shown above Value: Measured value Status: Good and Not Limited	
AL.79 OV.DISP	(None)	---	---	Value: Measured value Status: Good and Not Limited						

*1: Depend on the setting of hardware switch
*2: Depend on the direction of range over (high or low)

<table>
<tr><th rowspan="2">Integral Indicator</th><th rowspan="2">HART configuration tool display</th><th rowspan="2">Device Status</th><th rowspan="2">Extended Device Status</th><th colspan="7">Value and Status (Data Quality and Limit Status)</th></tr>
<tr><th>Flow</th><th>Differential Pressure (DP)</th><th>Static Pressure (SP)</th><th>External Temperature (ET)</th><th>Total Flow</th><th>% range</th><th>Loop current</th></tr>
<tr><td>AL.87
FLG. HI</td><td>FT high alarm</td><td rowspan="15">---</td><td rowspan="15">Maintenance Required
(0x01)</td><td colspan="5" rowspan="2">Value: Measured value
Status: Good and Not Limited</td><td colspan="2" rowspan="2">In the case “Off” is set to Diag Out Option
Value: Measured value
Status: Good and Not Limited
In the case “Burnout” is set to Diag Out Option
Value: Low Limited/ High Limited
Status: Bad and Low Limited/High Limited*1
In the case “Fall back” is set to Diag Out Option
Value: Fixed value
Status: Bad and Constant</td></tr>
<tr><td>AL.87
FLG. LO</td><td>FT low alarm</td></tr>
<tr><td>AL.88
INVR.DP</td><td>Invalid Ref DP</td><td colspan="7" rowspan="4">Value: Measured value
Status: Good and Not Limited</td></tr>
<tr><td>AL.88
INVR.SL</td><td>Invalid Ref SPL</td></tr>
<tr><td>AL.88
INVR.SH</td><td>Invalid Ref SPH</td></tr>
<tr><td>AL.88
INVR.F</td><td>Invalid Ref F</td></tr>
<tr><td>AL.89
ILBD.OV</td><td>ILBD over range</td><td colspan="7">Value: Measured value
Status: Good and Not Limited</td></tr>
<tr><td>AL.89
B BLK</td><td>B Blocking</td><td colspan="5" rowspan="8">Value: Measured value
Status: Good and Not Limited</td><td colspan="2" rowspan="8">In the case “Off” is set to Diag Out Option
Value: Measured value
Status: Good and Not Limited
In the case “Burnout” is set to Diag Out Option
Value: Low Limited/ High Limited
Status: Bad and Low Limited/High Limited*1
In the case “Fall back” is set to Diag Out Option
Value: Fixed value
Status: Bad and Constant</td></tr>
<tr><td>AL.89
H BLK</td><td>H Side Blocking</td></tr>
<tr><td>AL.89
L BLK</td><td>L Side Blocking</td></tr>
<tr><td>AL.89
H LRG</td><td>Large Fluct H</td></tr>
<tr><td>AL.89
L LRG</td><td>Large Fluct L</td></tr>
<tr><td>AL.89
A BLK</td><td>A Blocking</td></tr>
<tr><td>AL.90
SIM</td><td>Flow Simulation mode</td><td>---</td><td>Device Variable Alert
(0x02)</td><td>Value: Measured value
Status: Good and Not Limited</td><td colspan="3">Value: Measured value
Status: Good and Not Limited
or
Value: Simulation value
Status: Manual/Fixed and Constant</td><td>Value: Measured value
Status: Good and Not Limited</td><td colspan="2">Same as Value and Status of PV</td></tr>
</table>

*1: Depend on the setting of hardware switch
*2: Depend on the direction of range over (high or low)

<table>
<tr><th rowspan="2">Integral Indicator</th><th rowspan="2">HART configuration tool display</th><th rowspan="2">Device Status</th><th rowspan="2">Extended Device Status</th><th colspan="8">Value and Status (Data Quality and Limit Status)</th></tr>
<tr><th>Flow</th><th>Differential Pressure (DP)</th><th>Static Pressure (SP)</th><th>External Temperature (ET)</th><th>Total Flow</th><th>% range</th><th>Loop current</th></tr>
<tr><td>AL.91
F. SIM</td><td>F Simulate Mode</td><td rowspan="4">In the case of PV: Loop Current Fixed (0x08)</td><td rowspan="6">Device Variable Alert (0x02)</td><td>Value and Status: Flow simulation value</td><td colspan="5" rowspan="2"></td><td colspan="2">Same as Value and Status of PV</td></tr>
<tr><td>AL.91
P. SIM</td><td>P Simulate Mode</td><td rowspan="3"></td><td>Value and Status: Pressure simulation value</td><td colspan="3">Value: Measured value
Status: Good and Not Limited</td><td colspan="2" rowspan="4">Same as Value and Status of PV</td></tr>
<tr><td>AL.91
SP.SIM</td><td>SP Simulate Mode</td><td rowspan="2"></td><td>Value and Status: Static Pressure simulation value</td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>AL.91
ET.SIM</td><td>ET Simulate Mode</td><td colspan="2">Value: Measured value
Status: Good and Not Limited</td><td>Value and Status: Temperature simulation value</td><td></td></tr>
<tr><td>AL.91
TF.SIM</td><td>TF Simulate Mode</td><td>---</td><td colspan="3"></td><td>Value and Status: Total Flow simulation value</td><td colspan="2">Value: Measured value
Status: Good and Not Limited</td></tr>
<tr><td>AL.91
PCT. SIM</td><td>% Simulate Mode</td><td rowspan="2">Loop Current Fixed (0x08)</td><td rowspan="2">Device Variable Alert (0x02)</td><td colspan="5" rowspan="2">Value: Measured value
Status: Good and Not Limited</td><td colspan="2">Value and Status: Simulation value (%)</td></tr>
<tr><td>AL.91
AO.SIM</td><td>AO Simulate Mode</td><td colspan="2">Value and Status: Simulation value (mA)</td></tr>
</table>

*1: Depend on the setting of hardware switch
*2: Depend on the direction of range over (high or low)

5. Parameter Summary

Function	Label	Item	Contents	Default value	Handling *1
Analog output	AO alm typ	Analog output alarm type	High or Low		R
	AO lower limit	Lower limit of analog output	3.8000 to 21.6000 mA	3.8000 mA	W
	AO upper limit	Upper limit of analog output	3.8000 to 21.6000 mA	21.6000 mA	W
	Auto recover	Auto-recover from hardware error	Off or On	On	W
Analog output trim	Clear D/A trim	Reset analog output trim			M
	D/A trim	Analog output trim with ammeter			M
	Scaled D/A trim	Analog output trim with voltmeter			M
	Channel flags	Analog channel flags		0x00	R
Burst mode	Burst mode	Burst mode *2	Off or On HART 5 Off or Wired HART Enabled HART 7	Off	W
	Burst option HART 5	Burst option	Xmtr Variables, PV, % range/ current, Process vars/crnt		W
	Burst Xmtr Vals HART 5	Burst transmitter values			M
	Burst Command HART 7	Burst Command *2	Cmd 1: PV Cmd 2: % range/current Cmd 3: Dyn vars/current Cmd 9: Device vars w/status Cmd33: Device Variables Cmd 48: Read Additional Device Status.	Cmd 1: PV	W
	Burst Variable Code HART 7	Device Variable for the Burst Message *2	Max 8 slots.	Flow	W
	Burst Msg Trigger Mode HART 7	Burst Trigger Mode Selection Code *2	(Continuous, Window, Rising, Falling, On-change)	Continuous	R
	Set Burst Trigger HART 7	Configure burst trigger	Configure Burst Msg Trigger Mode and Burst Trigger Level		M
	Set Burst Period HART 7	Configure burst period	Configure Update Period and Max Update Period		M
	Burst Trigger Level HART 7	Burst Trigger Level *2		0.0	R
	Update Period HART 7	Update Period for Burst mode *2	Update period for burst message	Burst Message 1: 0.5sec 2: 60sec 3: 60sec	R
	Max Update Period HART 7	Max Update Period for Burst mode *2	Maximum update period for burst message	60 min	R
Date	Date	Date	**/**/**		W
Descriptor	Descriptor	Descriptor	16 alphanumerics		W

*1: Handling: R-Read only, W-Read & Write, M-Method, G-Applicable for option code DG6
*2: Max three Burst Messages (Burst Message 1, Burst Message 2, Burst Message 3)

Function	Label	Item	Contents	Default value	Handling *1
Device information	Country HART 7	Country code	US, JP, DE, FR, ES, RU, CN	JP	W
	Dev id	Device ID			R
	Distributor	Yokogawa			R
	Drain vent matl	Drain and vent plug material			W
	Extra No.	Customizaion number			R
	Ext SW	External zeroing permission	Disabled or Enabled	Disabled	W
	Fill fluid	Fill fluid			W
	Final asmbly num	Final assembly number			W
	Fld dev rev	Field device revision			R
	Gasket matl	Gasket material			W
	Isoltr matl	Capsule material			W
	Mftr Date	Manufactured date			R
	Model 1/MS Code 1	Memo field for MS code 1	32 alphanumerics		W
	Model 2/MS Code 2	Memo field for MS code 2	32 alphanumerics		W
	Model 3/MS Code 3	Memo field for MS code 3	32 alphanumerics		W
	Num of RS	Number of remote seal			W
	Process Conn matl	Process connection material			W
	Process Conn size	Process connection size			W
	Process Conn type	Process connection type			W
	PT100 Serial No.	Serial number of PT100			W
	RS fill fluid	Fill fluid of remote seal			W
	RS Isoltr matl	Remote seal material			W
	RS type	Remote seal type			W
	Serial No.	Serial number			R
	Sofftware rev	Software revision			R
	Style No.	Style number	Style number of product		R
	Universal rev	Universal revision	16 alphanumerics		R
	Cfg chng count HART 7	Configuration change counter		0	R
	Reset Cfg chng flag HART 7	Reset Configuration change flag			M
	Device Profile HART 7	Device Profile		Process automation device	R
	Max dev vars HART 7	Max device variables		3	R
	Model	Model	Model name + Measurement span in the Suffix Codes Ex) “EJX910 M”		R
Device Variable Simulation	Simulate HART 7	Execution of device variable simulation	Execute the simulation		M
Diag Applicable	Diag Applicable	Appicable blockage detection	Disabled or Enabled		RG
Diag DPComp	Diag DPComp	fDP compensation selection	Compensation or Non-compensation	Compensation	WG
Diag Error	Diag Error	Results detected by ILBD or Heat trace monitoring			RG

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*2: Max three Burst Messages (Burst Message 1, Burst Message 2, Burst Message 3)

Function	Label	Item	Contents	Default value	Handling *1
Diag Lim	Lim fDPmax	Upper limit for Ratio fDP		Refer to Table 4.2.3	WG
	Lim fDPmin	Lower limit for Ratio fDP		Refer to Table 4.2.3	WG
	Lim fSPlmax	Upper limit for Ratio fSPl		Refer to Table 4.2.3	WG
	Lim fSPlmin	Lower limit for Ratio fSPl		Refer to Table 4.2.3	WG
	Lim fSPhmax	Upper limit for Ratio fSPh		Refer to Table 4.2.3	WG
	Lim fSPhmin	Lower limit for Ratio fSPh		Refer to Table 4.2.3	WG
	Lim BlkFmax	Upper limit for BlkF		Refer to Table 4.2.3	WG
	Lim BlkFmin	Lower limit for BlkF		Refer to Table 4.2.3	WG
	Lim DPAvgmax	Upper limit for DPAvg		Refer to Table 4.2.3	WG
	Lim DPAvgmin	Lower limit for DPAvg		Refer to Table 4.2.3	WG
Diag Mode	Diag Mode	ILBD operation mode	Stop, Calculation, or Reference		WG
Diag Option	Diag Option	Alarm masking			WG
Diag Output	Diag Out Option	Output mode of 4-20mA when an advanced diagnostic alarm is generated	Off, Burnout, or Fall back	Off	WG
	Diag Fixed Out Val	4-20 mA output when an advanced diagnostic alarm is generated	3.8000 to 21.6000 mA	21.6 mA	WG
Diag Period	Diag Period	Sampling period per one Diag count		180 sec	WG
Diag Reference	Diag Description	Memo field	32 alphanumerics		WG
	Ref fDP	Reference value of fDP			WG
	Ref fDP Status	Status of Reference fDP			RG
	Ref fSPl	Reference value of fSPl			WG
	Ref fSPl Status	Status of Reference fSPl			RG
Diag Reference	Ref fSPh	Reference value of fSPh			WG
	Ref fSPh Status	Status of Reference fSPh			RG
	Ref BlkF	Reference value of BlkF			WG
	Ref BlkF Status	Status of Reference BlkF			RG
	Ref DPAvg	Reference value of DPAvg			WG
	Ref DPAvg Status	Status of Reference DPAvg			RG
Diag Ref Lim	Ref Lim fDPmin	Lower limit of fDP		7.0E-10	WG
	Ref Lim fSPmin	Lower limit of fSPl and fSPh		1.0E-10	WG
	Ref Lim BlkFmax	Upper limit of BlkF		0.5	WG
Diag Supp Count	Diag Supp Count	Detection count to generate an alarm			WG
Diag Variables	Ratio fDP	SQRT (fDP/Ref fDP).			RG
	Ratio fDP Status	Status of Ratio fDP			RG
	Ratio fSPl	SQRT (fSPl/Ref fSPl).			RG
	Ratio fSPl Status	Status of Ratio fSPl			RG
	Ratio fSPh	SQRT (fSPh/Ref fSPh).			RG
	Ratio fSPh Status	Status of Ratio fSPh			RG
	BlkF	Blockage degree characterized in comparison of high-pressure side and low-pressure side pressure fluctuation values			RG
	BlkF Status	Status of BlkF			RG
	DPAvg	Ratio of the average of differential pressure/pressure to the maximum span of an EJX transmitter.			RG
	DPAvg Status	Status of DPAvg			RG
	CRatio fDP	Compensated fDP			RG
	CRatio fDP Status	Status of CRatio fDP			RG
	NRatio fDP	Non-compensated fDP			RG
	NRatio fDP Status	Status of NRatio fDP			RG

*1: Handling: R-Read only, W-Read & Write, M-Method, G-Applicable for option code DG6
*2: Max three Burst Messages (Burst Message 1, Burst Message 2, Burst Message 3)

Function	Label	Item	Contents	Default value	Handling *1
Display setup	Bar Indicator	Bar indicator	Off or On	On	W
	Disp Out 1/Disp1	LCD output 1	PV %, Flow, Pres, SP, EXT. TEMP, ENGR.PV, or TOTAL FLOW	PV %	W
	Disp Out 2/Disp2	LCD output 2	PV %, Flow, Pres, SP, EXT. TEMP, ENGR.PV, TOTAL FLOW, or Not used	Not used	W
	Disp Out 3/Disp3	LCD output 3	(Ditto)	Not used	W
	Disp Out 4/Disp4	LCD output 4	(Ditto)	Not used	W
	Disp % Reso	% display resolution	Normal or High resolution	Normal	W
	Engr exp	User set exponent	---, x10, x100, x1000	--- or as specified	W
	Engr LRV	User set lower range value	Unit specified in Set Engr Unit	As specified	W
	Engr point	Decimal place for user set	0 to 4	2	W
	Engr URV	User set upper range value	Unit specified in Set Engr Unit	As specified	W
	ET disp point	Decimal place for external temperature	0 to 4	2	W
	Flow disp point	Decimal place for flow	0 to 4	2	W
	Modify Engr Unit	User set engineering unit			M
	Pres disp point	Decimal place for differential pressure	0 to 4	2	W
	Set Engr Unit	Engineering unit select			M
	SP disp point	Decimal place for static pressure	0 to 4	2	W
	TF disp point	Decimal place for total flow	0 to 4	2	W
	Squawk HART 7	Squawk	Specify the device under the communication (turn the LCD on).		M
DP setup	Pres Damp	Damping time constant for DP	0.00 to 100.00 sec		W
	Pres Min Span	Minimum span for differential pressure			R
	Pres LRV	Lower range value for differential pressure			W
	Pres LSL	Lower sensor limit for differential pressure			R
	Pres URV	Upper range value for differential pressure			W
	Pres USL	Upper sensor limit for differential pressure	0 to 4		R
Error log	Error log Clear	Clear error records			M
	Error log view	Error records	Log1 (latest) to log4		M
ET setup	ET Damp	Damping time constant for ET	0.00 to 100.00 sec		W
	ET Fixed	External temperature fix mode	No,Yes, or FALL BACK	No	W
	ET Min Span	Minimum span for external temperature			R
	ET LRV	Lower range value for ET			W
	ET LSL	Lower sensor limit for ET			R
	ET URV	Upper range value for ET			W
	ET USL	Upper sensor limit for ET			R
	Fixed ET Val	Temperature value at ET fix mode	20 °C (deg C)		W

*1: Handling: R-Read only, W-Read & Write, M-Method, G-Applicable for option code DG6
*2: Max three Burst Messages (Burst Message 1, Burst Message 2, Burst Message 3)

Function	Label	Item	Contents	Default value	Handling *1
Event Notification	Event Notification Control HART 7	Event Notification	(Enable event notification on token-passing data link layer, Off)	Off	W
	Device Status Mask HART 7	Event Masking			W
	Status group 1 to 11 Mask HART 7				
	Ext dev status Mask HART 7				
	Device Diagnostic Status 0 Mask HART 7				
	Device Diagnostic Status 1 Mask HART 7				
	AO saturated Mask HART 7				
	AO fixed Mask HART 7				
	Set Event Notification Timing HART 7	Configure Event Notification Timing	Configure Event Notification Retry Time, Event Max Update Time and Event Debounce Interval		M
	Event Notification Retry Time HART 7	Event Notification Retry Time			R
	Max Update Time HART 7	Max Update Time for Event Notification			R
	Event Debounce Interval HART 7	Event Debounce Interval	Debounce Interval to detect an event.		R
	Acknowledge Event Notification HART 7	Acknowledge Event Notification			W
	Event Status HART 7	Event Status	0x00 Approved event or no event 0x10 Configuration changed event pending 0x20 Device status event pending 0x40 More status available event pending		R
	Event Number HART 7	Event Number			W
	Time First Unack Event Triggered HART 7	Time First Unack Event Triggered			W
	Latched Cfg chng count HART 7	Latched Cfg chng count			W

*1: Handling: R-Read only, W-Read & Write, M-Method, G-Applicable for option code DG6
*2: Max three Burst Messages (Burst Message 1, Burst Message 2, Burst Message 3)

Function	Label	Item	Contents	Default value	Handling *1
Event Notification	Latched Device Status HART 7	Device status when event occurred			W
	Latched Status group 1 to 11 HART 7	Field device status when event occured			W
	Latched Ext dev status HART 7				
	Latched Device Diagnostic Status 0 HART 7				
	Latched Device Diagnostic Status 1 HART 7				
	Latched AO saturated HART 7				
	Latched AO fixed HART 7				
Flow setup	Flow Damp	Damping time constant for flow	0.00 to 100.00 sec		W
	Flow LRV	Lower range value for flow			W
	Flow URV	Upper range value for flow			W
	Vol Flow Base Dens	Volume Flow Base Density Value			W
Flg temp	Flg temp	Calculated flange temperature value			RG
Flg temp Coef	Flg temp Coef			0	WG
Flg temp Lim	Flg temp Hi Alarm Val	Upper limit of Flange temperature		120 °C (deg C)	WG
	Flg temp Lo Alarm Val	Lower limit of Flange temperature		-40 °C (deg C)	WG
Fluct Variables	fDP	Average value of the sum of squares of differential pressure/ pressure fluctuations			RG
	fDP Status	Status of fDP			RG
	fSPl	Average value of the sum of squares of low-pressure-sidestatic pressure fluctuations			RG
	fSPl Status	Status of fSPl			RG
	fSPh	Average value of the sum of squares of high-pressure-side static pressure fluctuations			RG
	fSPh Status	Status of fSPh			RG
Flg temp	Flg temp	Calculated flange temperature value			RG
Keypad Input	Change PV Assgn	Change the allocation to PV			M
	PV Damp	Damping time constant for PV			W
	PV is	Current PV			R
	PV LRV	Lower range value for PV			W
	PV URV	Upper range value for PV			W
Loop test	Loop test	Test output setting	Within AO lower and upper limits		M
	Test Auto Release Time	“Flow simulation”, “DO Test” and “Test output” duration time selection.	10min, 30min, 60min, 3h, 6h, 12h	10min	W
Low cut	Low cut	Low cut	0.00 to 20.00%	10.00%	W
	Low cut mode	Low cut mode	Off or On	Off	W

*1: Handling: R-Read only, W-Read & Write, M-Method, G-Applicable for option code DG6
*2: Max three Burst Messages (Burst Message 1, Burst Message 2, Burst Message 3)

Function	Label	Item	Contents	Default value	Handling *1
Master test	Master test	Software reset and self test			M
Message	Message	Message	32 alphanumerics	As specified	W
Model	Model	Model			W
Number of requested preambles	Num req preams	Number of requested preambles			R
	Num resp preams HART 7	Number of response preambles		5	W
Optional function	Option Password	Optional function activation password			W
Piping orientation	H/L Swap	Impulse piping accessing direction	Normal or Reverse	Normal	R
Poll address	Poll addr	Poll address for multidrop use	0 to 15(HART 5), 0 to 63(HART 7)	0	W
	Loop current mode HART 7	Loop current mode in Multi Drop mode	(Disabled, Enabled)	Disabled	W
Process Alerts	Digital Output	Display of contact output	Off or On	Off	W
	DO Frequency	Frequency of Digtal Output			W
	DO Select	Contact output select	Combination of Pres, SP, Temp, and Flow		W
	DO Signal type	Signal type select	On When Al. Detect, Off When Al. Detect, Scaled Pulse, or Frequency		W
	DO Test	Test output contact	Status High, Status Low, Freguency, Exit		M
	Test Auto Release Time	“Flow simulation”, “DO Test”, “Device Variable Simulation” and “Test output” duration time selection.	10min, 30min, 60min, 3h, 6h, 12h	10min	W
	Pres Alert Mode	Alert Mode for differential pressure	Off, Hi Al Detect,Lo Al Detect, Hi/Lo Al Detect	Off	W
	Pres Hi Alert Val	High alert value for differential pressure	Set the threshold value for high side alarm		W
	Pres Lo Alert Val	Low alert value for differential pressure	Set the threshold value for low side alarm		W
	SP Alert Mode	Alert Mode for static pressure	Off, Hi Al Detect,Lo Al Detect, Hi/Lo Al Detect	Off	W
	SP Hi Alert Val	High alert value for static pressure	Set the threshold value for high side alarm		W
	SP Lo Alert Val	Low alert value for static pressure	Set the threshold value for low side alarm		W
	ET Alert Mode	Alert Mode for external temperature	Off, Hi Al Detect,Lo Al Detect, Hi/Lo Al Detect	Off	W
	ET Hi Alert Val	High alert value for external temperature	Set the threshold value for high side alarm		W
	ET Lo Alert Val	Low alert value for external temperature	Set the threshold value for low side alarm		W
	Flow Alert Mode	Alert Mode for flow	Off, Hi Al Detect,Lo Al Detect, Hi/Lo Al Detect	Off	W
	Flow Hi Alert Val	High alert value for flow	Set the threshold value for high side alarm		W
	Flow Lo Alert Val	Low alert value for flow	Set the threshold value for low side alarm		W
Process variables	Change 4V Assgn HART 5	Change the allocation to 4V			M
	4V HART 5	4V value	Unit specified in 4V Unit		R
	4V is HART 5	Current 4V			R
	Amp temp	Amplifier temperature			R
	Cap temp	Capsule temperature			R
	Engr Disp	User scaled value	Unit specified in Set Engr Unit		R

*1: Handling: R-Read only, W-Read & Write, M-Method, G-Applicable for option code DG6
*2: Max three Burst Messages (Burst Message 1, Burst Message 2, Burst Message 3)

Function	Label	Item	Contents	Default value	Handling *1
Process variables	Engr exp	Exponents	x1, x10, x100, or x1000	As specified or -	W
	Engr Unit	User set engineering unit	Unit specified in Set Engr Unit		R
	ET	External temperature value			R
	ET Data Quality*3 HART 7	Device variable process data quality	Device variable process data quality of external temperature		R
	ET Limit Status HART 7	Device variable limit status	Device variable limit status of external temperature		R
	ET Update time period HART 7	ET Update time period		400ms	R
	Flow	Flow value			R
	Flow Data Quality*3 HART 7	Device variable process data quality	Device variable process data quality of flow rate		R
	Flow Limit Status HART 7	Device variable limit status	Device variable limit status of flow rate		R
	Flow Update time period HART 7	Flow Update time period		100ms	R
	Loop Current HART 7	Loop current value (Analog Output Current)	3.8 to 21.6 mA		R
	Loop Current Data Quality*3 HART 7	Device variable process data quality	Device variable process data quality of Loop Current (mA)		R
	Loop Current Limit Status HART 7	Device variable limit status	Device variable limit status of Loop Current (mA)		R
	Pres	Differential pressure value			R
	Pres Data Quality*3 HART 7	Device variable process data quality	Device variable process data quality of differential pressure		R
	Pres Limit Status HART 7	Device variable limit status	Device variable limit status of differential pressure		R
	Pres Update time period HART 7	Pres Update time period		100ms	R
	Change PV Assign	Change the allocation to PV			M
	PV	PV value	Unit specified in PV Unit		R
	PV is	Current PV			R
	PV % HART 5	PV value in %	-2.50 to 110.00%		R
	PV AO HART 5	Analog output current	3.8000 to 21.6000 mA		R
	PV Data Quality*3 HART 7	Device variable process data quality	Device variable process data quality of PV		R
	PV Limit Status HART 7	Device variable limit status	Device variable limit status of PV		R
	Change QV Assgn HART 7	Change the allocation to QV			M
	QV HART 7	QV value	Unit specified in QV Unit		R

*1: Handling: R-Read only, W-Read & Write, M-Method, G-Applicable for option code DG6
*2: Max three Burst Messages (Burst Message 1, Burst Message 2, Burst Message 3)

Function	Label	Item	Contents	Default value	Handling *1
Process variables	QV is HART 7	Current QV			R
	QV Data Quality*3 HART 7	Device variable process data quality	Device variable process data quality of QV		R
	QV Limit Status HART 7	Device variable limit status	Device variable limit status of QV		R
	% Range HART 7	% of range value (PV value in %)	-2.50 to 110.00%		R
	% Range Data Quality*3 HART 7	Device variable process data quality	Device variable process data quality of % Range		R
	% Range Limit Status HART 7	Device variable limit status	Device variable limit status of % Range		R
	SP	Static pressure value			R
	SP Data Quality*3 HART 7	Device variable process data quality	Device variable process data quality of static pressure		R
	SP Limit Status HART 7	Device variable limit status	Device variable limit status of static pressure		R
	SP Update time period HART 7	SP Update time period		100ms	R
	Change SV Assgn	Change the allocation to SV			M
	SV	SV value	Unit specified in SV Unit		R
	SV is	Current SV			R
	SV Data Quality*3 HART 7	Device variable process data quality	Device variable process data quality of SV		R
	SV Limit Status HART 7	Device variable limit status	Device variable limit status of SV		R
	Total Flow	Total flow value			R
	Total Flow Data Quality*3 HART 7	Device variable process data quality	Device variable process data quality of total flow		R
	Total Flow Limit Status HART 7	Device variable limit status	Device variable limit status of total flow		R
	Total Flow Update time period HART 7	Total Flow Update time period		1s	R
	Change TV Assgn	Change the allocation to TV			M
	TV	TV value			R
	TV is	Current TV			R
	TV Data Quality*3 HART 7	Device variable process data quality	Device variable process data quality of TV		R
	TV Limit Status HART 7	Device variable limit status	Device variable limit status of TV		R

*1: Handling: R-Read only, W-Read & Write, M-Method, G-Applicable for option code DG6
*2: Max three Burst Messages (Burst Message 1, Burst Message 2, Burst Message 3)

Function	Label	Item	Contents	Default value	Handling *1
Self test	Self test	Self-diagnostics			M
Sensor trim	Clear ET trim	Reset ET trim to factory setting			M
	Clear P snsr trim	Reset pressure trim to factory setting			M
	Clear SP snsr trim	Reset SP trim to factory setting			M
	ET trim	External temperature trim			M
	Pres trim	Pressure trim			M
	SP trim	Static pressure trim			M
	Trim Date	Trim date	**/**/**		W
	Trim Desc	Trim description	16 alphanumerics		W
	Trim Loc	Trim location	8 alphanumerics		W
	Trim Who	Trim person	8 alphanumerics		W
Simulation/ Flow Simulation	(Flow) Simulation Mode	Simulate Flow Mode			W
	(Flow) Sim Pres	Differential pressure value for simulation			W
	(Flow) Sim Pres Unit	Differential pressure unit for simulation			W
	(Flow) Sim SP	Static pressure value for simulation			W
	(Flow) Sim SP Unit	Static pressure unit for simulation			W
	(Flow) Sim Temp	Temperature value for simulation			W
	(Flow) Sim Temp Unit	Temperature unit for simulation			W
Basic Flow Calc	Flow Calc Fixed	Calculation fixation value of flow			W
	Flow Calc mode	Flow cauculation mode	Auto Comp. Mode or Basic Mode		W
	Fluid Type	Fluid type			W
	Ref SP	Referrence static pressure			W
	Ref Temp	Referrence temperature			W
	Temp K1	The first in temperature correction coefficient for liquid			W
SP setup	A/G Select				W
	Atm. Pres Value				W
	SP Damp	Damping time constant for SP		As specified or -	W
	SP H/L Select				W
	SP Min Span	Minimum span for static pressure			R
	SP LRV	Lower range value for static pressure			W
	SP LSL	Lower sensor limit for static pressure			R
	SP URV	Upper range value for static pressure			W
	SP USL	Upper sensor limit for static pressure			R

*1: Handling: R-Read only, W-Read & Write, M-Method, G-Applicable for option code DG6
*2: Max three Burst Messages (Burst Message 1, Burst Message 2, Burst Message 3)

Function	Label	Item	Contents	Default value	Handling *1
Status	Status group 1	Device status information for hardware	Display the hardware error		R
	Status group 2	Device status information for hardware	Display the hardware error		R
	Status group 3	Device status information for process	Display the process error (Out of specification)		R
	Status group 4	Device status information for process	Display the process error (Out of setting range)		R
	Status group 5	Device status information for process	Display the process error (Alarm)		R
	Status group 6	Device status information for data	Display the setting error		R
	Status group 7	Device status information for data	Display the setting error		R
	Status group 8	Device status information for data	Display the setting error and process error (Alarm)		R
	Status group 9	Device status information for data	Display the diagnostic alarm		R
	Status group 10	Device status information for data	Display the diagnostic alarm		R
	Status group 11 HART 7	Device status information for data	Display the simulation mode		R
	Ext dev status HART 7	Extended Device Status			R
Tag	Tag	Tag number	16 alphanumerics	As specified	W
	Long tag HART 7	Long tag	Max 32 alphanumerics	As specified	W
Test key	Test key	Special maintenance parameter			M
Total Flow	Cvt Val	Convert value for total flow base unit			W
	Freq at 100%	Digtal otput fequency at 100%			W
	Pulse rate	Pulse rate			W
	Modify Unit	Modify flow base unit			M
	Set Base Unit	Set total flow base unit			M
	Total Flow Mode	Total flow mode	Reset, Start, Start Cyclic or Stop		W
	Total Flow Unit	Current total flow unit			W
Units	Density Unit	Density unit			W
	ET Unit	External temperature unit			W
	Flow Unit	Flow unit			W
	Pres Unit	Differential pressure unit			W
	PV Unit	PV unit			W
	SP Unit	Static pressure unit			W
	SV Unit	SV unit			W
	Total Flow Unit	Total flow unit			W
	TV Unit	TV unit			W
	4V Unit HART 5	4V unit			W
	QV Unit HART 7	QV unit			W
Write protection menu	Enable wrt 10min	Write protection release	8 alphanumerics		M
	New password	User set password for write protection	8 alphanumerics		M
	Write protect	Write protection indicator	Yes or No	No	R

*1: Handling: R-Read only, W-Read & Write, M-Method, G-Applicable for option code DG6
*2: Max three Burst Messages (Burst Message 1, Burst Message 2, Burst Message 3)

Appendix 1. Safety Instrumented Systems Installation

WARNING

The contents of this appendix are cited from exida.com safety manual on the EJX series pressure transmitters specifically observed for the safety transmitter purpose. When using the EJX for Safety Instrumented Systems (SIS) application, the instructions and procedures in this section must be strictly followed in order to preserve the transmitter for that safety level.

A1.1 Scope and Purpose

This section provides an overview of the user responsibilities for installation and operation of the EJX in order to maintain the designed safety level for Safety Instrumented Systems (SIS) applications. Items that will be addressed are proof testing, repair and replacement of the transmitter, reliability data, lifetime, environmental and application limits, and parameter settings.

A1.2 Using the EJX for an SIS Application

A1.2.1 Safety Accuracy

The EJX has a specified safety accuracy of 2%. This means that the internal component failures are listed in the device failure rate if they will cause an error of 2% or greater.

A1.2.2 Diagnostic Response Time

The EJX will report an internal failure within 5 seconds of the fault occurrence.

A1.2.3 Setup

During installation the transmitter must be setup with engineering units parameters. This is typically done with a handheld terminal. These parameters must be verified during the installation to insure that the correct parameters are in the transmitter. Engineering range parameters can be verified by reading these parameters from the optional local display or by checking actual calibration of the transmitter.

The calibration of the transmitter must be performed after parameters are set.

A1.2.4 Required Parameter Settings

The following parameters need to be set in order to maintain the designed safety integrity.

Table A1.1 Required Parameter Settings

Item	Description
Burnout direction switch	To specify if the output should go 21.6 mA or higher or 3.6 mA or lower upon detection of an internal failure.
Write protection switch	The write function should be disabled.

A1.2.5 Proof Testing

The objective of proof testing is to detect failures within the transmitter that are not detected by the diagnostics of the transmitter. Of main concern are undetected failures that prevent the safety instrumented function from performing its intended function. See table A1.2 for proof testing method.

The frequency of the proof tests (or the proof test interval) is to be determined in the reliability calculations for the safety instrumented functions for which the EJX is applied. The actual proof tests must be performed more frequently or as frequently as specified in the calculation in order to maintain required safety integrity of the safety instrumented function.

The following tests need to be specifically executed when a proof test is performed. The results of the proof test need to be documented and this documentation should be part of a plant safety management system. Failures that are detected should be reported to Yokogawa.

The personnel performing the proof test of the transmitter should be trained in SIS operations including bypass procedures, EJX transmitter maintenance, and company management of change procedures.

Table A1.2 Proof Testing

Testing method	Tools required	Expected outcome	Remarks
Functional test: 1. Follow all Management of Change procedures to bypass logic solvers if necessary. 2. Execute HART/BRAIN command to send value to high alarm (21.5 mA) and verify that current has reached this level. 3. Execute HART/BRAIN command to send value to low alarm (3.6 mA) and verify that current has reached this level. 4. Restore logic solvers operation and verify.	• Handheld terminal	Proof Test Coverage =52%	The output needs to be monitored to assure that the transmitter communicates the correct signal.
Perform three point calibration along with the functional test listed above.	• Handheld terminal • Calibrated pressure source	Proof Test Coverage =99%	

A1.2.6 Repair and Replacement

If repair is to be performed with the process online the EJX will need to be bypassed during the repair. The user should setup appropriate bypass procedures.

In the unlikely event that the EJX has a failure, the failures that are detected should be reported to Yokogawa.

When replacing the EJX, the procedure in the installation manual should be followed.

The personnel performing the repair or replacement of the EJX should have a sufficient skill level.

A1.2.7 Startup Time

The EJX generates a valid signal within 1 second of power-on startup.

A1.2.8 Firmware Update

In case firmware updates are required, they will be performed at factory. The replacement responsibilities are then in place. The user will not be required to perform any firmware updates.

A1.2.9 Reliability Data

A detailed Failure Mode, Effects, and Diagnostics Analysis (FMEDA) report is available from Yokogawa with all failure rates and failure modes.

The EJX is certified up to SIL2 for use in a simplex (1oo1) configuration, depending on the PFDavg calculation of the entire Safety Instrumented Function.

The development process of the EJX is certified up to SIL3, allowing redundant use of the transmitter up to this Safety Integrity Level, depending the PFDavg calculation of the entire Safety Instrumented Function.

When using the transmitter in a redundant configuration, the use of a common cause factor (β-factor) of 2% is suggested. (However, if the redundant transmitters share an impulse line or if clogging of the separate impulse lines is likely, a common cause factor of 10% is suggested.)

Note that the failure rates of the impulse lines need to be accounted for in the PFDavg calculation.

A1.2.10 Lifetime Limits

The expected lifetime of the EJX is 50 years. The reliability data listed the FMEDA report is only valid for this period. The failure rates of the EJX may increase sometime after this period. Reliability calculations based on the data listed in the FMEDA report for EJX lifetimes beyond 50 years may yield results that are too optimistic, i.e. the calculated Safety Integrity Level will not be achieved.

A1.2.11 Environmental Limits

The environmental limits of the EJX are specified in the user's manual IM 01C25.

A1.2.12 Application Limits

The application limits of the EJX are specified in the user's manual IM 01C25. If the transmitter is used outside of the application limits, the reliability data listed in A1.2.9 becomes invalid.

A1.3 Definitions and Abbreviations

A1.3.1 Definitions

Safety	Freedom from unacceptable risk of harm
Functional Safety	The ability of a system to carry out the actions necessary to achieve or to maintain a defined safe state for the equipment/machinery/plant/ apparatus under control of the system
Basic Safety	The equipment must be designed and manufactured such that it protects against risk of damage to persons by electrical shock and other hazards and against resulting fire and explosion. The protection must be effective under all conditions of the nominal operation and under single fault condition
Verification	The demonstration for each phase of the life-cycle that the (output) deliverables of the phase meet the objectives and requirements specified by the inputs to the phase. The verification is usually executed by analysis and/or testing
Validation	The demonstration that the safety-related system(s) or the combination of safety-related system(s) and external risk reduction facilities meet, in all respects, the Safety Requirements Specification. The validation is usually executed by testing
Safety Assessment	The investigation to arrive at a judgment -based on evidence- of the safety achieved by safety-related systems

Further definitions of terms used for safety techniques and measures and the description of safety related systems are given in IEC 61508-4.

A1.3.2 Abbreviations

FMEDA	Failure Mode, Effects and Diagnostic Analysis
SIF	Safety Instrumented Function
SIL	Safety Integrity Level
SIS	Safety Instrumented System
SLC	Safety Lifecycle

Appendix 2. ILBD Check List

Fill out the below checklist according to the operation flow of the ILBD in order to keep the important information for the blockage detection.

Checklist (1/5)

No.	Items	Parameters	Result	Example
1	4-20 mA Analog Signal Setting • Select the output mode when an alarm is generaed.	Diag Out Option	Off: ☐	☑
			Burnout: ☐	☐
			Fall back: ☐	☐
		Diag Fixed Out Val	mA	21.6 mA
2	Status Output	DO Select	Pres: ☐	☐
			SP: ☐	☐
			Temp: ☐	☐
			Flow: ☐	☐
			Diag: ☐	☑
			All: ☐	☐
3	Stability of Pres (differential pressure/pressure) under normal condition • Check that the status of **Pres** is “GOOD”. • Check the maximum and minimum values of **Pres**.	Status		Good
		Pres	Max.:	Max.: 12.3 kPa
			Min.:	Min.: 12.1 kPa
4	**fDP** under normal condition • Check that the value of **fDP** is more than $7x10^{-10}$.	fDP	☐	☑
5	Start to obtain Reference values • Set "Reference" to **Diag Mode**.	Diag Mode	☐	☑
6	End of Reference Value Sampling • Check that **Diag Mode** is “Calculation” after the time set to "Diag Period" passed.	Diag Mode	☐	☑
7	Alarm setting • Record the status of Checkbox in **Diag Option**.	Diag Option		
		A Blocking	☐	☑
		Large Fluct L	☐	☑
		Large Fluct H	☐	☑
		L Side Blocking	☐	☑
		H Side Blocking	☐	☑
		B Blocking	☐	☑
		Invalid Ref F	☐	☑
		Invalid Ref SPH	☐	☐
		Invalid Ref SPL	☐	☐
		Invalid Ref DP	☐	☑
		ILBD over range	☐	☐

Checklist (2/5)

No.	Items	Parameters	Result	Example
8	Alarm status • Check the alarm status shown in **Diag Error**. • Check that the alarm status of “ILBD over range” is not shown in **Diag Error**.	Diag Error		
		A Blocking	☐	☐
		Large Fluct L	☐	☐
		Large Fluct H	☐	☐
		L Side Blocking	☐	☐
		H Side Blocking	☐	☐
		B Blocking	☐	☐
		Invalid Ref F	☐	☑
		Invalid Ref SPH	☐	☐
		Invalid Ref SPL	☐	☐
		Invalid Ref DP	☐	☐
		ILBD over range	☐	☐
9	ILBD parameters • Record the values of parameters for ILBD operation. • Check the status of parameters for ILBD operation. *: Record the value after checked that the status of each parameter is “GOOD”.	Diag Period		180
		Lim fDPmax		3.000000
		Lim fDPmin		0.300000
		Lim fSPlmax		5.000000
		Lim fSPlmin		0.500000
		Lim fSPhmax		5.000000
		Lim fSPhmin		0.500000
		Lim BlkFmax		0.600000
		Lim BlkFmin		-0.600000
		Lim DPAvgmax		1.000000
		Lim DPAvgmin		0.050000
		Diag Supp Count		3
		Ref fDP*		7.43245E-09
		Ref fSPl*		7.25765E-09
		Ref fSPh*		7.18374E-09
		Ref DPAvg*		5.36425E+00
		fDP*		7.48562E-09
		fSPl*		7.23277E-09
		fSPh*		7.14085E-09
		BlkF*		-0.287259
		DPAvg*		0.055957

Checklist (3/5)

Go to the following step according to the result of "Invalid Ref xx" shown in the **Diag Error** of 8th check item.

Diag Error				
Invalid Ref SPH	**Invalid Ref SPL**	**Invalid Ref DP**		**Check item**
☐	☐	☐	→	10-a
☑	☑	☐	→	10-b

☑: The alarm is generated.
☐: The alarm is not generated.

No.	Items	Parameters	Result	Example
10-a	Simulation of Blockage detection operation • H Side Blocking: 10-a-1 • L Side Blocking: 10-a-2 • Both Side Blocking: 10-a-3			
10-a-1	H Side Blocking • Close the high-pressure side valve completely.			
	• Record the values of **fDP**, **fSPl**, **fSPh**, **BlkF**, and **DPAvg** after the certain time, (**Diag Period X Diag Supp Count**), passed. *: Record the value after checked that the status is “GOOD”.	fDP*		7.48562E-09
		fSPl*		7.23277E-09
		fSPh*		7.14085E-09
		BlkF		-0.287259
	• Record the status of Checkbox in **Diag Option**. • Check that the alarms status of “A Blocking” and “H Side Blocking” are set. Note: If the alarm of “ILBD over range” is generated, the valve may be closed too much tightly. Open valve a little and record the updated status of the parameters.	Diag Option		
		A Blocking	☐	☑
		Large Fluct L	☐	☐
		Large Fluct H	☐	☐
		L Side Blocking	☐	☐
		H Side Blocking	☐	☑
		B Blocking	☐	☐
		Invalid Ref F	☐	☐
		Invalid Ref SPH	☐	☐
		Invalid Ref SPL	☐	☐
		Invalid Ref DP	☐	☐
		ILBD over range	☐	☐
	• Check that the alarm of “H Side Blocking” is generated. • Check that the alarm of “L Side Blocking” is not generated.	Diag Error		
		L Side Blocking	☐	☐
		H Side Blocking	☐	☑

Checklist (4/5)

No.	Items	Parameters	Result	Example
10-a-2	L Side Blocking • Close the low-pressure side valve completely.			
	• Record the values of **fDP**, **fSPl**, **fSPh**, **BlkF**, and **DPAvg** after the certain time, (**Diag Period X Diag Supp Count**), passed. *: Record the value after checked that the status is “GOOD”.	fDP*		7.48562E-09
		fSPl*		7.23277E-09
		fSPh*		7.14085E-09
		BlkF		-0.287259
	• Record the status of Checkbox in **Diag Option**. • Check that the alarms status of “A Blocking” and “L Side Blocking” are set. Note: If the alarm of “ILBD over range” is generated, the valve may be closed too much tightly. Open valve a little and record the updated status of the parameters.	Diag Option		
		A Blocking	☐	☑
		Large Fluct L	☐	☐
		Large Fluct H	☐	☐
		L Side Blocking	☐	☑
		H Side Blocking	☐	☐
		B Blocking	☐	☐
		Invalid Ref F	☐	☐
		Invalid Ref SPH	☐	☐
		Invalid Ref SPL	☐	☐
		Invalid Ref DP	☐	☐
		ILBD over range	☐	☐
	• Check that the alarm of “L Side Blocking” is generated. • Check that the alarm of “H Side Blocking” is not generated.	Diag Error		
		L Side Blocking	☐	☑
		H Side Blocking	☐	☐
10-a-3	Both Side Blocking • Close the both-pressure side valves completely.			
	• Record the values of **fDP**, **fSPl**, **fSPh**, **BlkF**, and **DPAvg** after the certain time, (**Diag Period X Diag Supp Count**), passed. *: Record the value after checked that the status is “GOOD”.	fDP*		7.48562E-09
		fSPl*		7.23277E-09
		fSPh*		7.14085E-09
		BlkF		-0.287259
	• Record the status of Checkbox in **Diag Option**. • Check that the alarms status of “H Side Blocking”, “L Side Blocking”, and “B Blocking” are set. Note: If the alarm of “ILBD over range” is generated, the valve may be closed too much tightly. Open valve a little and record the updated status of the parameters.	Diag Option		
		A Blocking	☐	☐
		Large Fluct L	☐	☐
		Large Fluct H	☐	☐
		L Side Blocking	☐	☑
		H Side Blocking	☐	☑
		B Blocking	☐	☑
		Invalid Ref F	☐	☐
		Invalid Ref SPH	☐	☐
		Invalid Ref SPL	☐	☐
		Invalid Ref DP	☐	☐
		ILBD over range	☐	☐
	• Check that the alarm of “B Blocking” is generated.	Diag Error		
		B Blocking	☐	☑

Checklist (5/5)

No.	Items	Parameters	Result	Example
10-b	Simulation of Blockage detection operation • Close completely the valve for the side where the alarm of Invalid Reference Value is not generated.			
	For the case that the high-pressure side value is closed; • Record the values of **fDP**, **fSPl**, **fSPh**, **BlkF**, and **DPAvg** after the certain time, (**Diag Period X Diag Supp Count**), passed. *: Record the value after checked that the status is “GOOD”.	fDP*		7.48562E-09
		fSPh*		7.14085E-09
	For the case that the low-pressure side value is closed; • Record the values of **fDP**, **fSPl**, **fSPh**, **BlkF**, and **DPAvg** after the certain time, (**Diag Period X Diag Supp Count**), passed. *: Record the value after checked that the status is “GOOD”.	fDP*		7.48562E-09
		fSPl*		7.23277E-09
	• Record the status of Checkbox in **Diag Option**. • Check that the alarms status of “B Blocking” is set. Note: If the alarm of “ILBD over range” is generated, the valve may be closed too much tightly. Open valve a little and record the updated status of the parameters.	Diag Option		
		A Blocking	☐	☐
		Large Fluct L	☐	☐
		Large Fluct H	☐	☐
		L Side Blocking	☐	☐
		H Side Blocking	☐	☐
		B Blocking	☐	☑
		Invalid Ref F	☐	☑
		Invalid Ref SPH	☐	☐
		Invalid Ref SPL	☐	☑
		Invalid Ref DP	☐	☐
		ILBD over range	☐	☐
	• Check that the alarm of “B Blocking” is not generated.	Diag Error		
		B Blocking	☐	☑

Revision Information

- Title : EJX910A and EJX930A
  Multivariable Transmitter HART Communication Type
- Manual No. : IM 01C25R02-01E

Edition	Date	Page	Revised Item
1st	Mar. 2005	—	New publication
2nd	Mar. 2009	—	Add model EJX930A.
3rd	Aug. 2009	3-25 and 3-26 3-30	3.5.10 Revise the description. 3.5.13 Add the detail of the status output hysteresis.
4th	Apr. 2010	 1-4 1-4 3-6 3-12 to 3-40 4-2 to 4-18 4-19 5-1 A-1	Revise the description for device revision 2. 1.4 Revise explanation of device revision. 1.5 Add explanation of DTM. 3.3 Add Advanced diagnostic and device revision 2 upgrade function menu. 3.4, 3.5, 3.6 Add device revision 2 upgrade function operation. 4.2 Add Advanced diagnostic operation (for option code /DG6). 4.3 Add alarms regarding Advanced diagnostic. 5 Add Advanced diagnostic and device revision 2 upgrade function parameters. Appendix 1 Add check list for ILBD.
5th	July 2011		Add HART 7
6th	Mar. 2012	2-3 3-6 3-13	2.4 Revise revision in formation in Table 2.2. 3.1.1 Add parameters in the Pres Setup (DTM) menu. 3.2.1 Change the limitation of 'Date' in the table.
7th	June 2014	3-22, 5-2	Revise default value of External Switch Mode.